Development of Cantonese as a heritage language in children

Experiments in phonology and morphosyntax

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Abstract

This dissertation examines the development of Cantonese in young heritage speakers (age of testing 3;10–12;3) in New York City. These heritage speakers were raised speaking predominantly Cantonese at home, but were exposed to English (the majority language) from a young age. The research investigates whether they were acquiring Cantonese in the same way as Cantonese-English peers in Hong Kong, where Cantonese is the majority language, and which factors contributed to stronger abilities in the heritage language.

The two groups of participants were compared in terms of tone discrimination, phonological production, and classifier production. The results showed that the heritage speakers discriminated between Cantonese tones less accurately, and that they spoke with lower native-likeness and lower comprehensibility. They were comparable to the participants in Hong Kong in producing the classifier structure, but were less able to use the appropriate classifier form. In the heritage speakers, age of testing predicted tone discrimination, and age of arrival and the amount of Cantonese input and output predicted classifier selection, but no other tested factors showed significant effects on the measures of Cantonese ability.

These findings indicate that young heritage speakers do not acquire Cantonese in the same way as majority language speakers, although they can still be undergoing development. The data presented in this dissertation provides a comparison of two groups of bilingual Cantonese speakers, and illustrates the individual differences among heritage speakers.

Preface

Ethical approval for the research presented in this thesis was obtained from the Department of Language and Linguistics Ethics Officer, on behalf of the Social Sciences Faculty Ethics Sub-Committee, University of Essex, on 12th October, 2015 and 16th November, 2016.

Chapter 3 *Development of tonal discrimination in young heritage speakers of Cantonese* has been submitted to the *Journal of Phonetics*. Chapter 4 *Phonological production in young speakers of Cantonese as a heritage language* has been submitted to *Language and Speech*. Chapter 5 *Production of Cantonese classifiers in young heritage speakers and majority language speakers* has been submitted to the *International Journal of Bilingualism*.

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Chapter 1

Introduction

Heritage speakers (HSs) are bilinguals who speak a language at home that is not the majority language of the society (Valdés, 2001). Some HSs are born as children to immigrants, so that their home language has a heritage status from birth. Other HSs are born in the homeland, but emigrate with their parents when they are young, and therefore become HSs at some point during childhood. HSs are exposed to the heritage language (HL) from birth regardless of where they are born, and input in the HL is usually available in the immigrant environment for as long as family members continue to use the language. Language classes, television and other media, interaction with other speakers of the language, etc. can also be sources of HL input. A turning point for HSs is often when they start attending school (e.g. nursery/kindergarten), when the use of the majority language increases dramatically (Grosjean, 1994; Lynch, 2003). As

a result, HSs typically come to use the majority language as their dominant language (Montrul, 2012; Schlyter, 1993; Scontras, Fuchs, & Polinsky, 2015).

The particular linguistic environment that HSs find themselves in creates a unique population of language users whose mother tongue is the weaker language. As such, uncovering the acquisition process of HLs during childhood can contribute to our understanding of how language develops in bilinguals. So far, there is evidence that HSs diverge from monolinguals early on (Jia, 2015; Stoehr, Benders, Van Hell, & Fikkert, 2017), and if these early differences persist into adulthood, they can explain why adult HSs are different from adult monolinguals (Montrul, 2008). Attrition and reanalysis can also occur, with previously acquired linguistic knowledge lost or reformulated in later years (e.g., O'Grady, Kwak, Lee, & Lee, 2011; Polinsky, 2008b, 2011). Both quantitative and qualitative differences have been observed, with HSs either resembling a monolingual at an earlier developmental stage, or exhibiting patterns that are not found in monolinguals at all (e.g., Jia, 2015; Kim, Montrul, & Yoon, 2010; Montrul & Sánchez-Walker, 2013). However, there are also studies showing that there are no differences between these two groups in certain aspects, or at least that the HSs have high level of command of their HL (e.g., Au, Knightly, Jun, & Oh, 2002; Kupisch, Akpinar, & Stöhr, 2013).

The study of HLs has a particular importance for HSs, because it is the less-supported language for them, in terms of opportunities for formal education and use, and research. While the majority language is usually the official language where the HSs are living,

the HL is a minority language, and in some cases HSs may not come into contact with other speakers of the same language outside the family very often. The HL is not only a means of communication that connects HSs to their families, but also a vessel of culture and traditions and a crucial component of self-identity. Researching HLs not only aids our understanding of languages, but also of the speakers themselves.

This thesis comprises three cross-sectional studies that examine HSs of Cantonese living in New York City and compare them to peers living in Hong Kong (Chapters 3–5). Cantonese is the vernacular and the majority language of Hong Kong, and steady immigration from Hong Kong and other Cantonese-speaking parts of China to the United States since the mid-19th century has resulted in sizeable and culturally distinct Cantonese-speaking communities in an English-speaking country. The studies seek to find out whether HSs develop differently in terms of tone discrimination, global accent and comprehensibility, and classifier production, and also what factors contribute to individual differences among HSs. The following sections review existing studies on HSs and introduce the target populations of this thesis.

1.1 Heritage speakers and heritage languages

1.1.1 Definitions

HLs are languages that are spoken in a home, but that are not dominant languages in the particular society or country of residence (Rothman, 2009; Valdés, 2001). Accordingly, HSs are speakers who speak an HL—usually one that is acquired naturalistically. Some speakers have a cultural connection to a language, but no proficiency in it prior to learning it in a classroom; these speakers tend to be termed second languge (L2) learners rather than HSs (e.g., Fishman, 2001; Montrul, 2016a; Rothman, 2009; Van Deusen-Scholl, 2003). HSs are exposed to the majority language through interacting with other members of society or attending school, and are therefore childhood bilinguals. However, they are a particular subtype of bilinguals, as there is a clear sociopolitical imbalance between the two languages; the home language is a minority language that in many cases is not official or state-supported (Montrul, 2008), which has consequences on the amount of exposure and opportunities for use, and support for learning. In HL research, most studied HLs tend to be immigrant languages, although other types of HL exist, such as national minority languages in the case of Inuttitut in Canada or Basque in Spain (Benmamoun, Montrul, & Polinsky, 2013a). In practice, there can be biased representation of HSs due to the adoption of performance-related criteria; speakers with too low a level of proficiency can be excluded if they do not have the necessary level of ability to complete an experiment, particularly if it involves production. In

addition, self-selection bias means that participants who consent to take part probably self-identify as proficient HSs (Nagy, 2014), or at least view the HL positively.

Nagy, Aghdasi, Denis, and Motut (2011) define speakers who moved to the host country after age 18 (and had been living in the new country for more than 20 years) as first generation speakers, while second generation speakers were those who moved when they were younger than 18 and had at least one first generation speaker parent. Silva-Corvalán (2014) defined first generation speakers as including both those who immigrated after age 8, and their children who were born in the host country or had immigrated before age 11 are second generation HSs. As the current thesis explores the development of Cantonese in young children living in the United States, the participants include both those born in the United States and those who moved there after birth, and their generation does not form part of the inclusion criteria.

1.1.2 Heritage language (HL) competence of heritage speakers (HSs)

As HSs start attending school and use more and more of the majority language, the amount of HL exposure and use decreases. HSs tend to quickly become dominant in the majority language, while the development of the HL is interrupted. As a result, by adulthood the HL is typically acquired to a proficiency level different to what is expected of (monolingual) first language (L1) speakers. An important characteristic of HSs is the large range in the abilities of HSs in the HL (Montrul, 2016a; Polinsky, 2016).

The exact level of HL performance depends on which ones are being investigated, and which speakers the HSs are being compared to.

There are studies in which HSs appear to perform like monolinguals and have excellent command of certain grammatical properties (e.g., Alarcón, 2011; Bianchi, 2013; Montrul, Foote, & Perpiñán, 2008; Håkansson, 1995; Kupisch et al., 2013; Leal Méndez, Rothman, & Slabakova, 2015; Montrul, de la Fuente, Davidson, & Foote, 2013; Montrul, Davidson, de la Fuente, & Foote, 2014; Santos & Flores, 2016). However, more studies show HSs to be divergent in their HL acquisition and less accurate in their language use compared to monolingual speakers. For example, there is plentiful evidence for non-convergence in certain areas of morphosyntax, although core syntax tends to be less affected (Polinsky & Kagan, 2007). In nominal morphology, HSs make more errors in gender and number agreement (Albirini, Benmamoun, & Saadah, 2011; Benmamoun, Albirini, Montrul, & Saadah, 2014; Håkansson, 1995), use fewer distinctions in morphosyntactic systems (Laleko, 2010; Polinsky, 2008a), or omit case markings altogether (e.g., Montrul & Bowles, 2009; Polinsky, 2006; Song, O'Grady, Cho, & Lee, 1997). With verbal morphology, while HSs appear to master tense systems reasonably well (Sherkina-Lieber, Perez-Leroux, & Johns, 2011; Silva-Corvalán, 2014), they struggle with aspect (Laleko, 2010, 2011; Mikhaylova, 2012; Polinsky, 2006). In sentence-level syntax, HSs are less competent in using long-distance dependencies (Kim, 2010), relative clauses (O'Grady, Kwak, et al., 2011), reflexive pronouns (Polinsky & Kagan, 2007), and displacement structures (Polinsky, Zhang, & Gómez Gallo, 2010). Some research has also been done on the

interpretation and use of overt/null pronouns and articles, and the results show that HSs' patterns of use are unlike that of monolinguals' (Albirini et al., 2011; Barski, 2013; de Groot, 2005; Kupisch & Barton, 2013; Montrul & Ionin, 2010). In terms of lexicon, HSs are weaker than monolinguals in using and accessing their vocabulary, including in tests of translation, recall, and picture naming (Hulsen, 2000; Polinsky, 2004, 2006; Polinsky & Kagan, 2007).

In phonology, some studies showed that HSs were not different from monolinguals in terms of perception (Kim, 2015; Lukyanchenko & Gor, 2011), and some studies have found the same for production (Kupisch, Lein, et al., 2014; Saadah, 2011). It has been suggested that because of the early acquisition of phonology in infants in general, HSs, many of whom are exposed mainly to the HL in the earliest stages of life, should acquire phonology in a more monolingual-like fashion. In contrast, the acquisition of certain morphosyntac areas, for example conditionals, takes place after the preschool age, which can coincide with the period when HSs interact with the environment outside the home and start acquiring the majority language. The acquisition of HL at this point is affected by the development of the majority language while phonology is relatively developed, and consequently HSs struggle less with phonology. However, some studies have still found differences between HSs and monolinguals in phonology (Godson, 2004; Kang & Nagy, 2012), indicating that target-like acquisition is not guaranteed by early exposure, but can be hindered by factors such as influence from an L2 (see Section 1.2, p. 28).

When compared to L2 learners, HSs tend to have advantages: since HSs are exposed to their HL from birth, they have the advantage of early exposure compared to L2 learners who come into contact with the language later in life. The contrast between HSs and L2 learners has been especially clear in phonology; in both perceiving and producing sounds, HSs have been found to perform more similarly compared to monolinguals while L2 learners were more different (Au et al., 2002; Kim, 2015; Knightly, Jun, Oh, & Au, 2003; Kupisch et al., 2013; Lukyanchenko & Gor, 2011; Oh, Jun, Knightly, & Au, 2003; Saadah, 2011). The picture is more mixed when looking at other domains. For morphosyntax and vocabulary knowledge, some studies find no differences between HSs and L2 learners (Au et al., 2002; Knightly et al., 2003; Bruhn de Garavito, 2002; O'Grady, Kwak, et al., 2011), while HSs were more target-like than L2 learners in other studies (Albirini & Benmamoun, 2014; Håkansson, 1995; Laleko & Polinsky, 2013; Zhang & Koda, 2016). HSs also appear to have no advantage or even be less competent than L2 learners with properties associated with print or formal varieties (Bowles, 2011; Montrul & Perpiñán, 2011; Zhang & Koda, 2016). This is likely due to differences between the two groups in terms of literacy and method of acquisition: HSs typically acquire their HL naturalistically and many are not literate in the HL, while L2 speakers tend to learn through classroom instruction using written material (Montrul, 2016a). Therefore, L2 learners receive more exposure to formal registers and structures used in written language, which HSs have much less access to.

There is often a discrepancy between HSs' productive and perceptive skills. HSs are

generally reported to have more advanced perceptive than productive skills, even in adulthood, and low levels of literacy means that the least developed skill is usually writing (Carreira & Kagan, 2011; Fishman, 2001; Valdés, 2001). In more extreme cases, the imbalance between the skills can create a form of receptive bilingualism (Baetens-Beardsmore, 1982), where speakers can comprehend some HL speech but do not speak the language (e.g., Knightly et al., 2003; Sherkina-Lieber et al., 2011; Weger-Guntharp, 2006). That HSs do not necessarily possess all the skills in their HS is one of the reasons for inter-generational loss: as one generation uses the HL less frequently, less input is available to the next generation, and so on. Therefore, speakers of earlier generations tend to be more proficient than those of subsequent generations (Silva-Corvalán, 2014).

1.1.3 The term 'heritage'

In this thesis, 'heritage' is used as a description for HSs' linguistic profile and not their language proficiency. Not only is the proficiency of HSs diverse and difficult to describe in one word, more importantly, HSs are similar to the comparison group—children from Hong Kong speaking Cantonese as the majority language—in many ways such that other linguistic terms do not adequately distinguish the two. For example, both groups of children are L1 speakers, as Cantonese was the first or one of the first language(s) that both groups were exposed to. In some cases a HS can be almost indistinguishable from a speaker from Hong Kong prior to the beginning of formal schooling, for example if the home environment is exclusively Cantonese, or if the HS was born and had lived

in the homeland before immigrating. In such cases, the difference in majority language is negligible and at best small for very young children, who are unlikely to spend much time outside the home, so that input from parents exerts the largest influence on language development in children.

Parents in Hong Kong are typically L1 speakers of Cantonese with a second or foreign language level of competence in English, and they would use mainly Cantonese at home. Immigrant families overseas are situated in a non-Cantonese speaking society, but parents dominant in Cantonese would likely use it at home. Granted, once formal schooling starts, HSs will most likely have more exposure to English and ultimately become more proficient English users than Hong Kong (HK) speakers, even though HK speakers also learn English in school. However, the relative proportion of exposure to Cantonese versus English can vary greatly depending on the particular situation of the individual families. For example, parents in Hong Kong may use more English at home to encourage the development of the L2 English that is perceived as a prestige marker and a key to their children's future success, while parents overseas can be conscious of the minority status of Cantonese and deliberately use it as much as possible.

Nevertheless, a consequence of the overlaps between the two groups of children is that terms like L1 versus L2, and monolingual versus bilingual, do not serve to contrast the two populations. Therefore, 'heritage' is used to distinguish the two groups in this thesis. Should there be no differences between the two groups in terms of linguistic ability or performance, using 'heritage speakers' nevertheless captures the differences

in the linguistic and sociocultural context that the two groups of children live in.

1.2 Bilingualism and HL development

Given the often non-monolingual-like competence of HSs, one aim of HL research has been to determine the reasons why HSs do not converge on the HL as spoken by monolinguals. The ultimate attainment of HSs in adulthood is determined by prior developmental processes, therefore child HSs are crucial to explaining the non-convergence of adult HSs. Studies on HSs as children, while less common than studies on adult HSs, have nevertheless shown the same pattern of results: that HSs already show divergences from monolingual peers when they are young (e.g., Anderson, 1999, 2001; Jia & Paradis, 2015; Kaufman, 2005; Li & Lee, 2001).

If young HSs were exposed to both the HL and the majority language from birth, they can be considered simultaneous bilinguals who undergo what is known as bilingual first language acquisition (De Houwer, 2009; Genesee & Nicoladis, 2006). If they were not exposed to the majority language until after age 3–4 (when they started attending school, or if they only moved to the host country then), then they are sequential bilinguals. The HL is the L1 and the majority language is acquired as the L2 (Li & Lee, 2001; Meisel, 2011). Either way, HSs are or become bilinguals at some point during early childhood, and bilingualism entails certain acquisitional conditions, such as lower absolute input in each language compared to monolingual speakers.

When a language is the only one in an individual's linguistic system, it develops more or less independently. However, when more than one language is being acquired, the two (or more) systems interact and influence each other. Cross-linguistic influence results in deceleration, acceleration, and transfer in either/both of a bilingual's two languages (Paradis & Genesee, 1996), and developmental differences lead to differences in acquisition outcome. For example, bilinguals take longer than monolinguals to acquire syntax (e.g., Swain, 1972) and phonology (Fabiano-Smith & Goldstein, 2010; Sebastián-Gallés & Bosch, 2002). There is also transfer, where elements from one language are used in the other (e.g., phonology: Fabiano-Smith & Barlow, 2010; syntax: Döpke, 1997; Hulk & Müller, 2000; lexical items: Li & Lee, 2000; Dewaele & Li, 2013). In addition, there is competition between the two languages for exposure and use. For example, the amount of input received in each language is reduced (Paradis & Genesee, 1996), and if the reduction is great enough, the input may prove to be insufficient. A bilingual has to acquire not only two sets of linguistic knowledge, but also two sets of extra-linguistic knowledge such as discourse customs (Yip & Matthews, 2007b). Even if bilinguals' language use is target-like, they differ from monolinguals in terms of non-linguistic capacities such as processing abilities, and face additional cognitive strain due to having two languages available at their disposal (e.g., Bialystok, 2001).

There is no a priori reason why bilinguals should not acquire both of their languages to monolingual-like levels; it has been argued that human beings have the 'bilingual instinct' (Yip & Matthews, 2007a) or are all bilinguals 'par excellence' (Hymes, 1974),

i.e. are all capable of acquiring two languages at the same time, given sufficient input in the environment. Cross-linguistic influence does not always have a negative effect on the acquisition of the target language(s) (e.g. when acquiring through bootstrapping or cognates), and learners may eventually converge on target-like linguistic knowledge under optimal acquisition conditions (Paradis, 2001; Paradis & Genesee, 1996). However, HSs' linguistic environments are often not sufficiently supportive of HL development, resulting in non-convergence despite the HL being the L1.

When compared to monolinguals or more balanced bilinguals, HSs receive only a low amount of input: the HL is typically only used at home and with relatives, while the majority language is used in school and in society. As soon as HSs enter school, their exposure to the majority language increases dramatically. They typically come to use the majority language more frequently relative to the HL, and may also start using the majority language at home (e.g. if assimilation with the mainstream culture is desirable for them or their families) (Rothman, 2009). Some families may also use the majority language at home some of the time, which further reduces the amount of HL input for HSs. According to the usage-based approach, less input means that HSs are less able to generalise rules and achieve form-function mappings successfully, leading to divergent HL behaviour (e.g., O'Grady, Lee, & Lee, 2011; Tomasello, 2003). The quantity of output is also important, as features of the HL that are used infrequently have low activation levels become more difficult to retrieve (Putnam & Sánchez, 2013).

In terms of quality, the input that HSs do receive can be limited in variety because it

comes from only a small group of speakers in a small range of contexts. In particular, the input received by HSs tends to be in everyday contexts in familiar situations, so, without formal schooling, there is little exposure to formal language or written material. Delays in HL development become very likely, and earlier developmental errors can fossilise when there is no opportunity for later and more complex structures to be acquired (Montrul, 2008; Polinsky, 2005, 2006). With little academic support for the HL during the school years, HSs often miss the chance to acquire literacy skills in that language.

In contrast to the HL, the majority language is well-supported through schooling and interaction with peers, and therefore, with more input and opportunities for practice, it develops more quickly. Even if HSs were balanced in both languages or more proficient in the HL to begin with, they can quickly become dominant in and come to prefer the majority language, which further disadvantages development in the HL (Döpke, 1998; Genesee, Nicoladis, & Paradis, 1995; Montrul, 2008; Yeni-Komshian, Flege, & Liu, 2000). This leads to a widening gap between the two languages. Such a situation is similar to the 'Matthew effect' in vocabulary development, where stronger readers acquire more new words through reading, while poorer readers struggle and fall even further behind (Hutchinson, Whiteley, Smith, & Connors, 2003; Stanovich, 1986); in the case of HSs, the majority language benefits from its majority status and is well-supported for development, while the disadvantaged HL develops at slower rate or fossilises at an earlier stage of development.

Attrition during childhood can also have an impact on the developmental course of the HL. Attrition refers to the loss of previously acquired linguistic knowledge (including partially mastered structures: Montrul, 2010). Parts of the HL can become attrited when speakers use the majority language more often, at the expense of the HL, which is used less often. It is likely that both fossilisation and attrition contribute towards the divergent competence of HSs compared to other speaker populations, although longitudinal research is required to separate their respective roles in the development of HLs (e.g., Pascual y Cabo & Rothman, 2012; Polinsky, 2008b; Schmid & Köpke, 2017). Speakers in the parental generation can also undergo attrition as a result of contact with the majority language and/or disuse of the HL (Montrul & Sánchez-Walker, 2013), and provide input to young HSs that is qualitatively unlike the input that children in the homeland receive.

While HSs already diverge from monolinguals during childhood, the HL can change—develop or attrite—throughout the speaker's lifetime, for example with aging, in response to contact with other languages, or because of changes in exposure and usage patterns. For example, HSs who attend language courses in university ('relearners', e.g. Kanno, Hasegawa, Ikeda, Ito, & Long, 2008; Song et al., 1997), or move to the homeland ('returnees', e.g. Flores and Rato, 2016; Treffers-Daller, Daller, Furman, & Rothman, 2016), will progress towards more target-like use of the HL, even if to a lower proficiency compared to a monolingual. Similarly, HSs with more target-like acquisition in childhood can experience attrition in later life if there is reduced use and exposure

to the HL (e.g. if a speaker moves away from a HL community).

1.3 Individual differences

Many of the factors that contribute to the differences between HSs and monolingual speakers also operate on an individual level. There is a large variety of outcomes for HL competence depending on the particular speaker, where those with a more favourable combination of factors tend to be more advanced users, and vice versa. The following section introduces some of the predictors of HL competence.

1.3.1 Input quantity and quality

Various studies have demonstrated that speakers receiving higher amounts of HL input become more competent in that language (Blom, 2010; De Houwer, 2007; Gatherole & Thomas, 2009; Gutiérrez-Clellen & Kreiter, 2003; Hoff et al., 2012; Jia, 2008; La Morgia, 2011; Unsworth, 2013; Unsworth et al., 2014). Input quantity can be calculated in terms of the current amount of HL input available relative to the majority language (e.g., Jia, 2008; Thordardottir, 2011), but also as the absolute amount of input received up to time of testing (e.g., Unsworth, 2013).

The size of the local HL community can affect the amount of input available (e.g., Place & Hoff, 2011). The more interlocutors there are, the more exposure there is to the HL

and the more opportunities to practise using the language. With larger HL communities come other channels of HL input, such as language classes, religious gatherings, or community activities conducted in the HL. There can also be local media outlets in the HL, providing input through TV programmes, local media, and print media (Jia, 2008; Kondo-Brown, 2005; Jia & Aaronson, 2003). Young children with working parents might attend childcare or after-school programmes provided in the HL. They can also take part in activities (e.g. sports training) with other children speaking the same language, although not all activities provide equally effective input for the purposes of language acquisition (e.g., Scheele, Leseman, & Mayo, 2010). In contrast, HSs from more isolated families that are far away from other speakers of the same language are unlikely to receive input outside of the home.

Parental choice also plays an important role in how much input child HSs receive. First, parents decide whether they use the HL with their child and how much, and therefore how much input is available at home. In addition, parents choose whether their children receive formal education in the HL—if it is available. HSs in places where the HL receives a certain degree of official recognition (e.g. Spanish in the United States) may be able to attend bilingual schooling, or at least take part in HL classes in school. After-school language classes are also sometimes an option. Education in the HL not only increases the amount of input received by children but also develops HL literacy, so that HSs can benefit from written input in addition to oral input (Lü & Koda, 2011).

Apart from quantity, the quality of input also affects the development/maintenance of

the HL (Jia & Paradis, 2015; Kondo-Brown, 2005; Place & Hoff, 2011). One aspect of quality is reflected in the diversity and richness of the input (Aalberse & Muysken, 2013; Jia, 2008; Jia & Aaronson, 2003; Jia & Fuse, 2007). For example, input that comes from more different people and sources, contains a wider range of linguistic structures and vocabulary, and covers more different topics, is qualitatively more diverse. The diversity and richness of input can also be related to speakers' socio-economic status (SES), for example measured by family income and parents' occupation and education level (Hoff, 2006; Jia & Paradis, 2015). Parents with higher SES would be able to offer their children more resources to learn the HL (such as by sending them to language classes or trips to the homeland), or to encourage their children to learn the HL for career reasons (Hinton, 1999; Van Deusen-Scholl, 2003). On the other hand, parents who are more assimilated into the majority society might not use the HL as often with their children. Therefore, the relation of SES with HL proficiency is not straightforward, with some studies finding higher SES linked to higher proficiency (e.g., G. Jia, 2008; R. Jia, 2016; R. Jia & Paradis, 2015), and others finding the opposite (e.g., Bohman, Bedore, Peña, Mendez-Perez, & Gillam, 2010; Sánchez, 1983; Siu, 1996; Yang, 2007).

Another aspect of quality of input concerns the proficiency or language use of the speakers providing the input. For example, if parents are first generation immigrants to the host country, it is possible that their HL, even if acquired to a monolingual-like level prior to immigration, undergoes attrition (e.g., Benmamoun, Montrul, & Polinsky, 2013b; Benmamoun et al., 2013a; Nagy et al., 2011; Sorace, 2004; Tsimpli, Sorace, Heycock,

& Filiaci, 2004). As a result, the input that they provide to their children can differ from how the HL is spoken in the homeland (Montrul & Sánchez-Walker, 2013), and children acquiring the HL through such input would not develop like a monolingual in the homeland. For example, if a particular structure is used only infrequently or even not at all in the parental generation, it is unlikely that HS children would acquire it (Gutiérrez-Clellen & Kreiter, 2003; Jia & Paradis, 2015). Because of this, overall HL proficiency may be observed to weaken generation by generation (e.g., Alba, Logan, Lutz, & Stults, 2002; Fishman, 1966). Siblings, who themselves are HSs and most likely developing divergently in the HL, can also provide input that is qualitatively different (Aalberse & Muysken, 2013). Input can also be provided by 'L2' speakers originally using different regional varieties or dialects, who then acquire (aspects of) the more common variety as a result of prolonged contact. For example, HSs of Chinese dialects such as Teochew might come to speak some Cantonese because of its predominant use in businesses and the community. Young HSs from Cantonese-speaking families might be exposed to Cantonese input from these L1 Teochew speakers, but such input is different from both input provided by a monolingual speaker in the homeland and by an adult HS of Cantonese without Teochew proficiency.

Finally, literacy in the HL enhances the quality of input accessible to speakers; some structures or vocabulary are used more in the literary style or written language, but are less common in the (spoken) vernacular, such as the inflected infinitives in Brazilian Portuguese (Pires & Rothman, 2009). It has been proposed that low literacy among HSs

explains why some structures are poorly acquired: they are simply not very frequent in the restricted, mostly oral input that HSs are exposed to (Bylund & Díaz, 2012; Kupisch & Rothman, 2016; Rinke & Flores, 2014; Rothman, 2009).

Although most studies focus on input, researchers have also pointed out the importance of active use (e.g., Putnam & Sánchez, 2013; Aalberse & Muysken, 2013). There is some evidence for the role of output in acquisition of the HL (e.g., Bohman et al., 2010; Unsworth, 2016). Although similar conditions to input quantity may apply to output quantity (e.g. number of interlocutors), there can be discrepancies between the amount of input and output even within the same context of use. For example, children dominant in the majority language might speak it to their parents, even though their parents, themselves dominant in the HL, would use the HL with them, in which case there is a higher amount of input but little output.

1.3.2 Age effects

The amount and type of input available are affected by the age of first exposure to the majority language (Montrul, 2008). The earlier this is, the more time is spent outside the HL environment, and therefore the lower the exposure to the HL. Often, this age effect is measured as the age of arrival (AOA) in the host country. Children with younger AOA shift more quickly to using the majority language compared to those with older AOA (Jia & Aaronson, 2003), and they are also less proficient in the HL (Anderson, 1999,

2001; Jia, Aaronson, Young, Chen, & Wagner, 2005; Montrul, 2002, but see Montrul & Foote, 2014). Comparisons against speakers immigrating in adulthood have also shown that younger immigrants undergo more extensive attrition (Ammerlaan, 1996; Hulsen, 2000; Polinsky, 2005). As younger speakers are less proficient when they arrive in the host country, they can be more susceptible to language loss upon contact with the majority language.

In comparison, HS with older AOA immigrate with a more advanced and stable knowledge of their L1, which contributes to HL maintenance (Allen, 2007; Montrul, 2008; Polinsky, 2004; Jia, 2016). They benefit from having developed longer in an HL environment prior to emigration, although it is important to control for the effects of age of testing, because for speakers of the same AOA, older children may have a larger cumulative amount of HL input than younger children (e.g., Flores & Barbosa, 2014). Speakers with later AOA may also have the advantage of attending school and acquiring literacy in the L1. Even though they will also face reduced HL input in the host country, they might be able to make more progress given the input that they receive, or have a higher incentive to keep using the HL due to their higher proficiency. On the other hand, speakers with later AOA might also face maturational constraints in acquiring the L2 majority language, and therefore rely more on the HL. The effect is not just linguistic; older immigrants could be psychologically more resistant to learning a new language or assimilating into a different culture (Zhang & Slaughter-Defoe, 2009). In contrast, speakers immigrating at a younger AOA may be more positive towards the

culture and language of the host country (Cheung, Chudek, & Heine, 2011; Choi & Thomas, 2009; Kuo & Roysircar, 2004).

AOA is not applicable to HSs born in the host country, but a similar measurement (also relevant to very young arrivals) is the age of onset of the majority language. The point of consideration is the same with AOA: the time at which frequent exposure to the majority language begins and HL use decreases.

1.3.3 Sociological factors

Sibling order is one of several sociological factors that predict the level of HL acquisition and maintenance; older siblings have been shown to be more proficient, to use the HL more often, and to be more connected with their parents' culture, while younger siblings tend to use the majority language (Jarovinskij, 1995; Kigamwa, 2016; Parada, 2013; Pyke, 2005; Shin, 2002). When older siblings are still only children, their parents may speak mainly the HL with them. However, once the older siblings attend school, they may start speaking the majority language at home. This not only reduces the proportion of HL input at home available to younger siblings, but also potentially drives parents to shift towards using the majority language at home, as parents try to match their children's language preference and also become more proficient in the majority language after a longer period of living in the host country (Bridges & Hoff, 2014; Montrul, 2016b).

Proficiency in the HL is also tied to speakers' self-identity, such as in terms of how well they identify with the heritage culture and with other HSs of the same language. Proficiency in a HL does not only confer linguistic ability, it is also a symbol of membership to a particular community and inheritance of cultural wealth. Speakers with a closer connection to their heritage culture appear to be more proficient in the HL (e.g., Jia, 2008; He, 2010; Lee, 2002; Leung & Uchikoshi, 2012; Luo & Wiseman, 2000). In contrast, speakers who identify less with their heritage culture are likely to view the HL more negatively and hence be reluctant to speak it, and therefore have lower levels of proficiency (Lee, 2002).

In some cases, children's attitude towards (and consequently use of) the HL is a reflection of their parents' and peers' attitudes (e.g., De Houwer, 2007). If parents project resignation towards the maintenance of the HL, then their children are even less likely to be motivated to speak the HL or to form an identity attached to the heritage culture (Hinton, 1999). Other parents might wish for their children to assimilate more quickly into mainstream culture and therefore encourage use of the majority language, in contrast to parents who value their heritage and ensure that the associated cultural and linguistic knowledge is passed on to their children (Lee, 2002; Zhang, 2010). Family language policy affects whether and how much the HL is used in conversations and other activities that children are engaged in, and is therefore crucial in shaping young speakers' attitudes and habits concerning the HL.

Society's view of minority communities and multilingualism can also play a role; HSs

living in societies that are less receptive towards minorities may feel threatened or ashamed, or they may wish to distance themselves from their heritage due to repression, persecution, or other undesirable experiences related to their background (Aalberse & Hulk, 2016; Aalberse & Muysken, 2013; Bonner, 2001; Cho, 2000; Polinsky, 2015; Tse, 2000). Even for HSs of the same HL, living in different communities or different host countries can mean a different experience. For example, currently New York City schools receive a holiday for the Chinese (Lunar) New Year and there are large parades to celebrate the New Year, so that young HSs from Chinese backgrounds there might feel that there is official recognition of their culture, and perhaps be encouraged to embrace their HL. That said, HSs' attitudes towards their heritage and the HL can also change over their lifetime (He, 2006), for example as a result of changes in their relationship with parents, in their social group, or their cultural/self-identity. Investigating what factors predicts HL competencies at an individual level helps us understand the large variation among HSs.

1.4 Cantonese as the majority language and as the HL

Cantonese is a non-inflectional language, and despite the large number of Cantonese speakers around the world (estimated at 62 million by Asher and Moseley in 2007 in China, including Macau and Hong Kong, with 10 million more speakers elsewhere according to Simons and Fennig, 2017), it is among the less commonly researched

HLs. This section introduces Cantonese and where it is spoken as a majority language and HL respectively. To begin with, there is considerable disagreement on whether Cantonese is a language or a Chinese dialect. However, since English and Cantonese are typologically distant, more distant than dialects would usually be from another, Cantonese will be referred to henceforth as a language. Another reason for this decision is that the 'language' is the unit more commonly used in terms of language development, such as in 'first language', as opposed to 'first dialect', etc. Accordingly, the terms 'first language', 'heritage language', etc. will be used without a particular intent to indicate whether Cantonese is a language or not.

However, a few facts may help clarify the status of Cantonese. Cantonese is a prestigious form of the Yue subdivision of Chinese, and is spoken in southern China, in particular in the eponymous Guangdong Province. Its development was centered around Guangzhou, the capital city of Guangdong. The occupation of Macau and Hong Kong by the Portuguese and the British respectively resulted in large Cantonese-speaking populations relatively isolated from the influence of language policies in mainland China. In the rest of Guangdong and the neighbouring Guangxi province, Mandarin was the national language and was heavily promoted by the Chinese government, although Cantonese remained influential and is still widely-used today despite the lack of official status. The Cantonese that is the target of investigation in this study refers to Cantonese 'proper' or 'standard' Cantonese, which includes the mutually intelligible and widely-used forms that are spoken in Hong Kong, Macau, and Guangzhou. There are some minor regional

differences between the varieties of Cantonese, particularly in terms of phonology and lexicon. There are also other Yue dialects (e.g. Taishanese/Hoisanwaa) and non-Yue dialects (e.g. Hakka, Teochew) that are native to Guangdong and Guangxi.

Cantonese is a spoken language, and does not have a standardised written form; Standard Written Chinese is the written variety that is used by Cantonese speakers, which has clear differences in vocabulary and grammar from the spoken Cantonese (Matthews & Yip, 2011). While it is possible to use existing (standardised) Chinese characters to represent spoken Cantonese in writing, doing so would not produce what is considered correct language for written purposes (Snow, 2004). In some cases, a spoken word may not even have a standardised equivalent written form. There is no standard written form or prescriptive grammar, which has helped promote constant and localised change, particularly in terms of vocabulary (Matthews & Yip, 2011). Because of the differences between what Cantonese speakers speak and write and also the high likelihood that many HSs would not be literate in Chinese, this thesis only examined speakers' oral productive and receptive skills.

1.4.1 Hong Kong: the speech community

The official languages of Hong Kong are 'the English and Chinese languages' (HKSAR Department of Justice, 2017), without further specification. In practice, Cantonese is the lingua franca, at least among the ethnic Chinese who make up 92% of the population

(HKSAR Census and Statistics Department, 2017). As of 2016, 88.1% of the Hong Kong population aged 6–65 spoke Cantonese as a mother tongue. English is used in official documents and in the media, and code-mixed with Cantonese in daily/colloquial language. It is taught from an early age starting from preschool/kindergarten, and is a compulsory subject in all 12 years of compulsory schooling. Compared to Cantonese, English is reserved for more official uses or the business sector, and can almost be considered a 'foreign' language. It is also associated with the past experience of the British elite, and to this day English is still seen as a somewhat prestigious language in Hong Kong (Chan, 2017; C. S. Li, 1999; D. Li, 2009). Recently, Mandarin has assumed a higher importance with the ascendance of influence and connections from mainland China. Mandarin is taught in schools, and is increasingly used as the medium of teaching the Chinese language.

The pattern of language use in Hong Kong varies among individual speakers. To use the description of bilingualism as a continuum (Valdés, 2001), Hong Kong people who speak Cantonese as an L1 fall on different points of a continuum between a monolingual Cantonese speaker and monolingual English speaker. The relative use of Cantonese and English depends on factors such as medium of instruction (for students), cultural identity, and whether it is required for work or social reasons. For children, a unique source of English input as they are growing up can be live-in migrant domestic workers. Some of these workers (e.g. those from the Philippines) use English to communicate with their employers and participate in the daily routines such as taking children to

school and accompanying the children at home, and therefore create a partly English environment for the children. Some research even indicates a positive effect of an English-speaking domestic worker on children's English proficiency (Tang, 2015; Tse et al., 2009). Therefore, even though Cantonese is the main vernacular used in Hong Kong, English is not entirely absent from children's daily lives outside the classroom, and exposure can also come from sources such as parents and the television.

1.4.2 Cantonese as an HL

Large-scale emigration of Chinese people started in the 19th century. Some moved to countries in Asia, such as Vietnam, Malaysia, and Indonesia, where to this day there are still sizeable ethnic Chinese populations. Other immigrants went to western countries as labourers. Many of them were Cantonese-speaking, although the exact variety depended on where individual speakers were from. There was also a significant number speaking other Yue dialects, such as Taishanese and Fuzhounese. There were certain hotspots for settlement that are today known for their large and vibrant Chinese communities, such as New York, Sydney, and Vancouver. Indubitably, the experience of individual HSs varied depending on the strength of the local Cantonese-speaking community, but in several cities around the world, the establishment of Chinese businesses and local associations ensured that the Cantonese language and culture remains significant even after decades of immigration. Recently, there has been an overall shift in the demographics of Chinese immigrants towards Mandarin-speakers, such that Mandarin

as an HL has also gained importance. After immigration, some adults, such as those who have Chinese employers, are socially more isolated, or have lower educational levels and SES status, and so do not have much need or many opportunities to learn the majority language (e.g., Zhang, 2010). In contrast, children attending local schools learn and socialise in the majority language, and so can quickly become proficient users.

This thesis focusses on HSs from New York City. The most recent census data shows that 0.76% of the United States population aged 5 years or older who speak a language other than English at home are Cantonese speakers (458,840 +/- 6,487), and the figure for New York County is at 2.16% (13,320 +/- 1,338) (United States Census Bureau, 2015). Across the United States, the Cantonese speakers make up 15.84% of the population who speak a Chinese language (including Mandarin and Hakka) at home, while in New York County they make up 16.83%. An older survey found that 31% of the Chinese population in New York City was Cantonese-speaking (Pan, 1997). The Chinese community in New York City is large enough such that it is possible to identify geographical sub-enclaves based on the dominant dialect spoken. In earlier days, Chinese immigrants to New York settled in Manhattan. The Chinese community in Brooklyn started growing in the late 1980s in an area along 8th Avenue, and as those who gradually gained the financial ability to settle in other areas, newer arrivals took their place on 8th Avenue (Reed, 2017).

Given the large number of Cantonese HSs, however, the literature on Cantonese as an HL (and even Mandarin as an HL) is sparse. Since Cantonese also differs from

other widely-spoken HLs (e.g. German, Spanish) in that it is primarily spoken and typologically distinct, it offers a unique opportunity to research HL and bilingual development. Therefore, the research presented in the following chapters aims to contribute to the field by investigating Cantonese as an HL and focussing on some less-researched language features.

1.4.3 Control group

In this thesis, children in Hong Kong were tested as a control group. Choosing this population allows the two groups of participants to be more comparable, since both are bilingual. HSs, as bilinguals, can hardly be expected to be comparable to monolinguals due to natural differences in their (linguistic and wider) environments (Cook, 1997; Paradis, Crago, Genesee, & Rice, 2003; Paradis & Genesee, 1996). For example, a bilingual speaker generally has fewer opportunities for exposure and production in either of his languages compared to a monolingual speaker, since his total language experience is distributed between the two languages. Choosing children in Hong Kong, who speak both Cantonese and English, means that the effects of bilingualism are controlled for. Another way of including a bilingual control group would be to test L2 learners, who, like the HSs, are bilinguals with the target language as the weaker language (e.g., Kim, 2015; Santos & Flores, 2016). However, since there are few L2 learners of Cantonese, especially in comparison to L2 learners of more popular foreign languages such as Spanish and Mandarin, this direction was not pursued.

The decision to use bilinguals as a control group does not mean that monolinguals cannot serve as a baseline in linguistic research. Monolinguals illustrate how a given language develops in the absence of influence of other languages, and for many languages, especially the less globally-used ones, monolingual speakers also represent the biggest population using a particular language, in the widest range of contexts and for the largest number of purposes. The most important point to consider when choosing a comparison group is that the group is appropriate for the particular research question being explored. For example, monolingual speakers and bilingual L1 speakers might serve equally well as control groups, but comparing HSs to the former might address the effects of bilingualism on HL acquisition, while comparing HSs to the latter might address the effects of the minority status of the HL on its development. Monolinguals can serve as a useful control for HSs, as long as comparisons are not be conducted with the belief that the monolinguals are an absolutely linguistic model or ideal, or that HSs who have a lower level of proficiency than the monolinguals are deficient in any way (Benmamoun et al., 2013a; Pascual y Cabo & Rothman, 2012).

However, even if it were decided that Cantonese monolinguals would form the control group, it would be difficult to find strictly monolingual speakers in any case. Arguably, all L1 speakers of Cantonese in this day and age would be bilingual, or at least bidialectal to some extent: in Hong Kong, Cantonese speakers learn English starting from school age, if not before, and continue to be exposed to English throughout formal schooling and through the media. In other parts of China where Cantonese is used, L1 speakers

also speak Mandarin, and learn English at school. Additionally, Cantonese speakers could also speak other Chinese dialects or foreign languages. Therefore, what can be controlled for is to what extent Cantonese speakers are proficient in their other language(s). Some researchers have chosen to not make any direct comparisons with monolingual speakers for lack of normative data (e.g., Li & Lee, 2001).

1.5 Research questions

This thesis examines two overarching research questions:

1. How does Cantonese develop in HSs, as compared to in majority language speaker peers?
2. What factors predict the HSs' Cantonese abilities?

These two questions are addressed in three studies, each looking at a different aspect of Cantonese. The first study (Chapter 3) focussed on the perception of tonal contrasts. Sound perception is one of the earliest acquired skills in children (Jusczyk, Houston, & Newsome, 1999; Kuhl, 1985), but studies on HL phonology have mostly focussed on segmentals (e.g., Godson, 2004; Ronquest, 2013). Therefore, HSs' ability to perceive tonal contrasts was investigated using a discrimination task. The research questions of this chapter include:

1. Do HSs differ from majority language speakers in their acquisition of Cantonese tone discrimination?

2. What factors predict the ability of HSs to discriminate Cantonese tones?

The second study (Chapter 4) also targeted phonology, but looked at production on a global level. The HSs' speech was rated by L1 adult speakers from Hong Kong, with scores given based on native-likeness and comprehensibility. The participants were also classified based on their perceived demographic background. The research questions of this second study include:

1. Are HSs' perceived accent and comprehensibility comparable to the control group's?
2. Are the two groups similar in terms of where they were perceived to be from?
3. What is the role of different language background factors in predicting HSs' native-likeness and comprehensibility?

The third study (Chapter 5) looked at the production of classifiers. Even though morphology is one of the more studied domains of HLs, most of the research focusses on Indo-European languages and inflectional morphology (e.g., Montrul & Bowles, 2009; Polinsky & Kagan, 2007). Therefore, this study targeted classifiers, which is a morphosyntactic feature for non-inflectional languages. A picture-naming task was used to test the development of HS participants' ability to produce classifiers and to use the appropriate forms. The research questions of this chapter include:

1. Is classifier knowledge in young HSs comparable to that in majority language speaker peers?
2. What language background factors play a role in HSs' knowledge of Cantonese classifiers?

Chapter 2

Methodology

2.1 Participants

2.1.1 Heritage speakers (HS) and Hong Kong (HK) speakers

HS participants were recruited from three primary schools in New York City. They were all taking part in a daily after-school programme for elementary school children (Pre-Kindergarten up to Fifth Grade), which took place in the public schools where the students were studying. All three schools were located in areas with a relatively high proportion of Chinese residents, and approximately half or more of the student population in each school was reported as Asian (New York City Department of Education, 2017). All of the teaching staff of the after-school programme were Chinese

and spoke one or more of the Chinese varieties. Most of the students taking part in the after-school programme were also Chinese, but generally English was spoken to and amongst the students.

As the HSs would be compared to a control group of majority language speakers of Cantonese, it was intended that the two groups would be as similar as possible in terms of their home language use. Therefore, only HSs whose family used predominantly Cantonese were recruited to take part in the study. Such children were first identified by the after-school programme staff, and then their home language use was confirmed using a short language use questionnaire distributed to their parents. This questionnaire was written in Chinese, and consisted of five questions (translation in Appendix A.3, p. 195). Only the children who used Cantonese most or all of the time at home and had their parents' consent to take part were tested (see Section 2.3 on ethical considerations).

A total of 88 HSs were tested, but not all of them were included in all three studies of this thesis, for reasons such as unwillingness or inability to complete the task(s). The number of participants included in each study and their background are detailed in each article (see also Table 2.7 on page 62). The following description of the HSs is based on data from all 88 HSs. The data was collected using a language background questionnaire (LBQ; see Section 2.2.2). It should be noted that the parents did not always answer all the questions, especially those targeting relatively personal information (e.g. parents' place of birth and occupation).

There was a similar number of HSs from each gender, with 41 male and 47 female participants. Participants' age of testing (AOT) ranged from 3;10–11;3, and the average AOT was 8;5 (SD = 1;8). Table 2.1 shows the age of the HSs. Recruitment targeted children that were distributed across the age range as much as possible.

65 children from Hong Kong were recruited as control speakers, including 25 male participants and 40 female participants. They were all students at local primary schools, and were recruited with the criteria that they used mainly Cantonese at home and that their parents were native speakers of Cantonese.

The HK participants had been recruited with the intention of matching the age of the HSs, but since the schools that the HSs were attending served Pre-Kindergarten to Fifth Grade while those in Hong Kong served Primary 1–6, the HK participants were older overall ($t(151) = 2.98$, $p < 0.01$). The HK group participants were aged 5;2–12;4, and the average AOT was 9;4 (SD = 1;10).

AOT	HS (n)	HK (n)
3–3;11	1	0
4–4;11	1	0
5–5;11	4	1
6–6;11	13	7
7–7;11	20	8
8–8;11	12	13
9–9;11	17	10
10–10;11	18	11
11–11;11	2	11
12–12;11	0	4
Total	88	65

Table 2.1 Age of participants

Birthplace

Table 2.2 shows the birthplace of the participants. The majority of the HSs (n = 56) were born in the United States. Of the 26 HSs whose birthplace was reported as 'China', 16 specified they were born in Guangdong Province. For the 32 participants born outside the United States, the AOA ranged from 0;5–9;4 (mean = 4;6, SD = 2;6), and the LOR in the United States ranged from 5 months to 10.48 years (mean = 4.25 years, SD = 2.54 years). AOA was correlated with both AOT (r = 0.43, p < 0.01) and LOR (r = -0.75, p < 0.001), with older participants arriving later and having lived in the United States for a shorter period of time. 53 HSs reported not having visited China, while the rest had travelled there one or more times.

All of the HK participants were born in Hong Kong, apart from one who was born in China and had moved to Hong Kong at the age of 0;5.

Birthplace	HSs	HK
Hong Kong	5	64
US	56	0
China	26	1
Mexico	1	0

Table 2.2 Participants' birthplace (n)

Parents' birthplace, education level, and occupation

The HSs' parents came mostly from China (n = 118), and Table 2.3 shows their place of birth. On average, the parents rated themselves highly proficient in Cantonese, again on a scale of 1–6: on average 5.59 (Mdn = 6, SD = 0.93) and 5.69 (Mdn = 6, SD = 0.74) on listening and speaking respectively for fathers, and 5.67 (Mdn = 6, SD = 1.02) and

5.53 (Mdn = 6, SD = 1.02) for mothers. Other languages used with parents included Mandarin, English, and Hoisanwaa. Most of the HK participants' parents were born in Hong Kong (n = 61, Table 2.3). They rated themselves highly proficient in Cantonese, on average 5.95 out of 6 (Mdn = 6, SD = 0.22) and 5.92 (Mdn = 6, SD = 0.38) on listening and speaking respectively for fathers, and 5.74 (Mdn = 6, SD = 0.98) and 5.69 (Mdn = 6, SD = 1.04) respectively for mothers. Self-rated Cantonese proficiency was higher for the parents of the HK group than for the parents of the HSs. However, the differences were significant only for fathers' self-ratings in listening and speaking (U = 1734.5, p < 0.01; U = 1837.5, p < 0.05), and the differences between mothers' self-ratings for listening and speaking were not significant (ps > 0.05).

The parents' occupations and education levels are listed in Tables 2.4 and 2.5. The parents' occupations were coded using the occupation scale in the Hollingshead Four Factor Index of Socioeconomic Status (Hollingshead, 1975), where ascending scores on the scale correspond with increasing occupational prestige.

Place	HS	HK
Hong Kong	5	61
China	118	31
Mexico	1	3
Vietnam	1	1
Indonesia	0	1
n/a	51	33

Table 2.3 Parents' birthplace (n)

Languages spoken and language proficiency

35 HSs reported having some knowledge of the written form of Chinese. 6 HSs reported

	HK	HS
Prefer not to say	11	32
Secondary	56	71
Undergraduate	34	8
Postgraduate	13	0
Vocational	2	16
n/a	14	49

Table 2.4 Parents' education levels (n)

Occupation prestige	HS	HK
0	1	1
1	13	1
2	51	9
3	8	11
4	5	2
5	2	1
6	6	16
7	9	34
8	6	19
9	4	10
n/a	71	26

Table 2.5 Parents' occupations (n)

acquiring their literacy in Cantonese, 7 in Mandarin, and 19 in a mix of both. In the three studies in this thesis, only participants who could read and write more than just a few words (n = 30) were considered as literate in Chinese (see Questions 7–10 of the LBQ, Appendix A.4.1, p. 197). 26 of the HSs were taking Chinese classes, with 12 learning Cantonese, 11 Mandarin, and 3 a mix of both. Other than Cantonese and English, the HSs also spoke Mandarin (n = 16), Hoisanwaa (7), Minnan (1), Spanish (1), and French (1), although the last two were foreign languages being learnt at school and not languages spoken at home. The HK participants all spoke Cantonese and English,

and some also spoke Mandarin (n = 36), Teochew (1), Hoisanwaa (1), and Minnan (1).

The participants' Cantonese and English proficiency were assessed using the Peabody Picture Vocabulary Test, 4th edition (PPVT-4; Dunn & Dunn, 2007) (see Section 2.2.1 for more details on the PPVT). The mean raw score of the HSs on the Cantonese test was 64.61 (SD = 36.87), and on the English test it was 100.88 (SD = 34.67). The mean standardised score on the English test was 79.43 (SD = 17.47). Since the Cantonese version of the test was a direct translation of the English original and not standardised, standardisation was not applied to the Cantonese scores, and the above scores do not necessarily show that the HSs were more proficient in English than in Cantonese. The HK participants scored on average 174.33 (SD = 32.68) and 63.83 (SD = 33.42) in raw scores on the Cantonese and English tests respectively, and 52.44 (SD = 24.32) on the English test in standardised score. The HK group achieved higher Cantonese raw scores (β = 27.12, p < 0.001), even with AOT controlled for (β = 2.77, p < 0.01). For English vocabulary, the groups were compared on the (age-)standardised PPVT scores, and the results showed that the HSs had larger English vocabularies than the HK group (t(111.62) = -7.43, p < 0.001).

The HSs' proficiency was also estimated using ratings given by their parents, on a scale of 1–6, with 1 as not being able to understand or speak any Cantonese words, and 6 as being able to understand everything or speak fluently in all situations (Questions 3–4 of the LBQ). The mean ratings for HSs' Cantonese listening and speaking were 4.04 (Mdn = 3, SD = 1.63) and 3.87 (Mdn = 4, SD = 1.26) respectively, while the means for

English listening and speaking were 4.97 (Mdn = 6, SD = 1.33) and 4.66 (Mdn = 5, SD = 1.30) respectively. A Wilcoxon signed-rank test showed that on average, the HSs were rated higher for English than for Cantonese for both listening (Z = -3.25, p < 0.001) and speaking (Z = -3.39, p < 0.001). However, it is unclear how reliable the parents' ratings for English were, as there was no information on whether and to what extent the parents were proficient in English.

The HK group's parents gave high ratings for the participants' Cantonese proficiency, with an average of 5.81 (Mdn = 6, SD = 0.69) and 5.73 (Mdn = 6, SD = 0.68) for Cantonese listening and speaking respectively (on a scale of 1–6). The average rating for Chinese reading was 4.94 (Mdn = 5, SD = 0.90), and for Chinese writing it was 4.89 (Mdn = 5, SD = 1.05). For English, the HK group received average ratings of 3.97 (Mdn = 4, SD = 1.32) and 3.65 (Mdn = 4, SD = 1.10) for listening and speaking respectively. On average, the HK speakers received higher ratings for Cantonese than English for both listening (Z = -6.02, p < 0.001) and speaking (Z = -6.78, p < 0.001).

According to the ratings given by the participants' parents, the HK group was more proficient than the HSs in Cantonese, but the HSs were more proficient than the HK group in English. The HK participants received higher ratings for Cantonese listening and speaking (U = 870, p < 0.001; U = 589, p < 0.001). On the contrary, the HSs received higher ratings on both English listening and speaking (U = 1303.5, p < 0.001; U = 1182.5, p < 0.001).

Cantonese use

Table 2.6 lists the average proportion of Cantonese use by parents with the the participants and vice versa, and shows that Cantonese was used predominantly between the HSs and their parents (> 70%), as well as between the HK group and their parents (> 85%). There was no difference between the HSs and the control group in terms the proportion of Cantonese use by the parents with the participants, whether by the father or the mother (ps > 0.05). However, the HSs used less Cantonese than the HK participants when speaking with their parents (with father: U = 2040.5, p < 0.05, with mother: U = 1758.5, p < 0.05), with a difference of 13.29% and 17.5% respectively.

	HS		HK	
	Mean (SD)	Mdn	Mean (SD)	Mdn
Father with participant	78.09 (28.88)	100	84.13 (19.21)	75
Mother with participant	75.94 (30.93)	100	89.23 (18.21)	100
Participant with father	75.90 (30.61)	100	87.70 (13.40)	100
Participant with mother	71.08 (30.86)	75	88.93 (14.09)	100

Table 2.6 Proportion of Cantonese use (%) between participants and their parents

33 of the HSs were only children, with the rest reporting one or more siblings. On average, Cantonese was used 55.64% of the time in the communication between the HSs and their siblings (Mdn = 50%, SD = 34.09%). Other members of family living in the same household included grandparents, aunts and uncles, and cousins. The average proportion of Cantonese used with these other members of family was 73.68% (Mdn = 100%, SD = 44.63%). 30 of the HK group were only children, and 35 had one or more siblings. On average, Cantonese was used 88.24% of the time in the communication

between the HK participants and their siblings (Mdn = 100%, SD = 18.74%). 13 of the participants had grandparents living with them, and 20 had live-in foreign domestic helpers. The average proportion of Cantonese used with these other members in the same household was 84.62% (SD = 23.53%) with the grandparents, and 19.08% (SD = 36.03%) with the domestic helpers; some of the grandparents spoke a Chinese dialect, and although domestic helpers are normally not L1 speakers of Cantonese, many will have learnt Cantonese for employment purposes. Overall, the HK group used more Cantonese with their siblings than HSs did (U = 404.5, p < 0.001), but they used less Cantonese with adult members of the same household (excluding parents) (U = 175.5, p < 0.05).

At school, the HSs were taught mostly in English, with Cantonese used only 9.93% of the time (Mdn = 0%, SD = 24.10%), and the HSs also used mainly English with their classmates, and Cantonese only 15.94% of the time (Mdn = 0%, SD = 28.11%). In contrast, the majority of the HK group (n = 45) were taught in Cantonese at school most or all of the time. Nine were taught mostly or only in English, and 11 were taught in both evenly. Mainly Cantonese was used with schoolmates (Mdn = 100% of the time, M = 86%, SD = 18.2%). Overall, the HK group received teaching in more Cantonese than the HSs did (U = 338, p < 0.001), and they also used it more often with their classmates (U = 238, p < 0.001).

In terms of extra-curricular and leisure activities, the HSs used mainly English. Cantonese was used on average 26.42% of the time for conversing with friends, sports, and

when attending church (where applicable) (Mdn = 12.5%, SD = 33.62%). They watched Cantonese programmes on the television 34.47% of the time (Mdn = 25%, SD = 33.04%), and viewed Chinese content 17.80% when on the computer (Mdn = 0%, SD = 30.46%). The HK group used mostly Cantonese for these other activities, for example 93.30% of the time for conversing with friends, sports, and when attending church (where applicable) (Mdn = 100%, SD = 12.97%). In terms of watching television and using the computer, Cantonese content was viewed 67.37% (Mdn = 75%, SD = 17.53%) and 70% (Mdn = 75%, SD = 27.54%) of the time respectively, with English media accessed the rest of the time. Overall, the HK group used more Cantonese during these activities compared to the HSs (U = 194.5, p < 0.001).

In summary, the HSs used mainly Cantonese at home, especially with parents, while at school and for other activities English was used more often. On the other hand, the HK group used mainly Cantonese in their daily lives, but use of Mandarin and English was also common if less frequent.

Appendix C (p. 236) summarises the scores of all participants who were tested for this thesis. As previously mentioned, not all participants contributed data to all three studies in this thesis. The numbers of participants included in each study are listed in Table 2.7.

	HS	HK
Study 1 (Tone discrimination)	67	64
Study 2 (Classifier production)	62	71
Study 3 (Phonological production)	51	12

Table 2.7 Number of participants included in each of the three studies

2.1.2 Adult raters

The second study (Chapter 4) involved adult L1 speakers of Hong Kong Cantonese (HKCAN) who rated samples of speech produced by the children participants. 30 raters were recruited, and they were all born and raised in a HKCAN-majority environment. None of them had received any specific phonetic training or Chinese language teaching, and did not use any variety or dialect of Chinese regularly other than Cantonese. They had all learnt English at school, and many also spoke some Mandarin. 12 of the raters had immersion in an English-dominant environment within the last two years, but not before completing secondary education.

2.2 Materials

Table 2.8 lists the tasks used in this thesis and the target participant group.

Details of the PPVT and the LBQ are given below. The remaining tasks are described in the relevant chapters (see Table 2.8).

Task	Target participant group
PPVT (Cantonese, English)	HS and HK children (Section 2.2.1, p. 63)
Tone discrimination task	HS and HK children (Section 3.2.2, p. 80)
Story-telling task	HS and HK children (Section 4.2.2.2, p. 116)
Picture-naming task	HS and HK children (Section 5.2.2.1, p. 144)
Verbal LBQ	HS and HK children (Section 2.2.2, p. 64)
Rating task	L1 adult speakers (Section 4.2.2.2, p. 116)
Written LBQ	Parents (Section 2.2.2, p. 64)

Table 2.8 Tasks used in this thesis

2.2.1 Cantonese and English vocabulary size

Participants' receptive vocabulary size in Cantonese and English were measured using the Peabody Picture Vocabulary Test—Fourth Edition (PPVT-4; Dunn & Dunn, 2007). During the test, the participant is shown four pictures, and is asked to indicate which picture corresponds to the word that the administerer is saying. The testing begins with 4 practice items, and the items are administered in sets of 12. The basal (starting) set is determined by the participant's age, and if more than one error is made in this set, then testing works backwards until a set is completed with 1 or 0 errors. Once the basal set has been determined, testing continues until there are 8 or more errors in a set. There is a maximum of 228 items.

The Cantonese version of the test was obtained by translating each English test item into the closest Cantonese equivalent.[1] Three adult first language speakers were recruited

[1] The Cantonese version of the PPVT used in Kidd, Chan, and Chiu (2015) was available for use, but in some questions a different picture had been used as the target in order to ensure comparable difficulty between the Cantonese and the original English version. Ultimately, it was decided that for this thesis the original targets would be retained, so that the same target vocabulary items would be used for both the Cantonese and the English tests. The Cantonese translation was carried out from scratch.

to evaluate the appropriateness of the translations. All three had experience in teaching young children in Hong Kong and were familiar with the language that children used.

The PPVT comes in two parallel forms (A and B). The two forms contain different items, but are considered statistically equivalent. Because of this feature, participants could be tested in both Cantonese and English—each on a different form (e.g. on form A for Cantonese and B for English)—without being tested on the same items. The form used for each language was counterbalanced across participants.

Participants' responses were scored using the PPVT's record forms, and the raw scores were calculated according to the test manual. A standard score was also obtained for the English test, but not for the Cantonese test as the test items were not standardised for Cantonese.

2.2.2 Language background questionnaire (written and verbal)

A language background questionnaire (LBQ) for parents was used to collect information on the (children) participants' family and linguistic background. The questionnaire was adapted from the BiLingual Language Experience Calculator (BiLEC, Version 4) (Unsworth, 2013), and while the BiLEC in its original form was designed to be administered orally, here it was delivered as a questionnaire on paper so that participants who were tested in schools could take the questionnaire home to their parents. The questionnaire was available to the parents in both Chinese and English, but most parents

who were present at the testing chose the Chinese version, and it was also the Chinese version that was given to participants to take home.

The English questionnaire for the HSs is shown in Appendix A.4.1 (p. 197). The English questionnaire for the HK group is shown in Appendix A.4.2 (p. 211). There are only minor differences between the versions for the two groups of children. For example, where it says 'United States' for the HSs it says 'Hong Kong' for the HK group.

A verbal version of the LBQ was administered to the participants as part of the testing. For the HSs, this was done in English as all of them preferred to answer in English, while the HK children all chose to use Cantonese. This version followed the written questionnaire as closely as possible, but the questions that the children were unlikely to answer reliably (e.g. on parents' Cantonese proficiency) were excluded. The parents' responses were always used in the analysis in the first instance, but there were 16 HSs whose parents did not return the LBQ, in which case the HSs' own responses were used. The HSs' responses were also used for questions that were not answered in the returned questionnaires.

2.3 Procedure

2.3.1 Ethics

Ethical approval for this study was obtained from the Social Sciences Faculty Ethics Sub-Committee, University of Essex. Written consent was obtained from the parents of all children under age 16 and from all adult participants.

2.3.2 Children participants

Children participants were recruited using a letter to their parents, which explained the purpose and the procedure of the study. Parents who were willing to let their children take part in the study were asked to sign a consent form that indicated their understanding of the study and their willingness for their data and their children's data to be used in the study. Both Chinese and English versions of the invitation letter and consent form were available, but as with the LBQ, in most cases it was the Chinese version that were used.

The children were tested in one session. Often the parents or school staff would have briefed the children before the study, but the researcher also explained in simple terms the purpose of the study and the participant's role. The tasks were administered in the following order: Cantonese PPVT, tone discrimination task, picture-naming task,

story-telling task, English PPVT, and finally the verbal LBQ. As much of the instructions were delivered in Cantonese as possible, but English had to be use for some of the HSs if they did not appear to understand the instructions in Cantonese. The children were rewarded with sweets and/or small stationery items at the end of the session, and were asked to take the written LBQ home to their parents. Parents who had accompanied their children to the testing venue filled out the questionnaire while their children were being tested.

2.3.3 Raters

Adult raters were recruited using invitation letters or emails, and their eligibility was checked before they attended the testing session. (The requirement was that they had been born and raised in a HKCAN-majority environment). At the beginning of each session, raters were given an information sheet to read, and they also signed a consent form. They completed the rating task (Section 4.2.2.2, p. 116), and received £18 or the equivalent in Hong Kong Dollars for their participation. This part of the study was partially supported by a Seedcorn Grant from the ESSEXLab.

Chapter 3

Development of tonal discrimination in young heritage speakers of Cantonese

3.1 Introduction

The present study investigates the development of tone perception in HSs of Cantonese in the United States. The participants were children who lived in neighbourhoods with a relatively high proportion of Chinese-speaking inhabitants who spoke predominantly Cantonese at home. It was hypothesised that the early emergence of tonal knowledge in infants in general and the relatively high level of exposure to Cantonese would favour target-like acquisition of tones in these participants.

3.1.1 HL phonology

The ability to discriminate and produce contrastive sounds is fundamental to identifying, comprehending, and producing words (Kuhl, 2004; Werker, Byers-Heinlein, & Fennell, 2009). Perhaps not coincidentally, the knowledge of the phonetics and phonology of the native language develops early in infants and children (Jusczyk et al., 1999; Kuhl, 1985). In terms of perception, HSs have been found to be mostly monolingual-like (Kim, 2016; Lukyanchenko & Gor, 2011). HSs benefit from, among other things, exposure to the language from a very young age, and so are more accurate in perceiving and producing sounds in target languages compared to L2 learners (e.g., Au et al., 2002; Boomershine, 2013; Chang, Yao, Haynes, & Rhodes, 2011; Oh et al., 2003; Knightly et al., 2003). These benefits are observed even if the exposure is for a brief period of time, as found in adoptee studies (e.g., Choi, Broersma, & Cutler, 2017; Oh, Au, & Jun, 2010; Zhou, 2015). In fact, Choi et al. (2017), studying adults in the Netherlands adopted from Korea, found that the advantage for adoptees in (re)learning target phonology was similar whether the adoption had taken place at age 3–5 months or after 17 months, indicating native language phonology can stabilize as early as before age 6 months. These studies suggest that even if exposure to a language is brief, early exposure leads to stable acquisition of at least some aspects of phonetics/phonology, which persist into later childhood and even adulthood.

However, many studies on production have found that HSs do not all attain monolingual-like phonetic abilities in their HL, despite early exposure to the language (e.g., Godson,

2004; Rao, 2015; Ronquest, 2013). In some cases, the HL is produced with characteristics of the majority language (Godson, 2004). The research so far suggests that divergence of the HL occurs only on a phonetic level, and phonemic contrasts in the HL are maintained (Chang et al., 2011; H. Tse, 2016). HSs' non-monolingual-like phonetic abilities, at least in production, can be explained by their bilingualism (e.g., Sebastián-Gallés & Bosch, 2002; Flege, Schirru, & MacKay, 2003). The Speech Learning Model (SLM, Flege, 1995, 2007), originally developed for L2 acquisition, postulates that first language (L1) and L2 sound categories exist in a common phonological space, which leads to interaction between the two systems. L2 sounds that are less similar to the closest L1 equivalent are more likely to be dissimilated, with the phonetic contrast fully represented, whereas similar sounds in L2 and L1 may undergo equivalence classification and be assimilated into one single phonetic category. Through these two processes, sounds originally contrastive in the L2 may not be categorised as such by learners, and the later the start of learning is, the poorer the production of L2 sounds. However, established L1 sounds can also change over time as a result of interaction with the L2 (e.g., de Leeuw, Tusha, & Schmid, 2017). When applied to HSs, the SLM predicts that the interaction of the HL with the majority language can affect the formation of HL sound categories or alter established ones, so that HL phonology diverges from monolinguals'.

However, HL phonology is not similarly acquired in all HSs, and there is a great variation at an individual level produced by the interaction of various factors such as age of arrival (AOA), quantity and quality of input, and sociolinguistic factors (Polinsky & Kagan,

2007). For example, HSs with later AOAs are more native-like in their phonological production compared to speakers with earlier AOAs (Flores & Rato, 2016; Godson, 2004). More input and output has also been found to be advantageous for HL production (Rao, 2015; Oh et al., 2003). Since some input providers will undergo more extensive phonetic attrition than others, the input received by individual HSs can be qualitatively different (Chang et al., 2011). Sociolinguistic factors have also been considered, such as language preference (Kupisch, Barton, et al., 2014). The above studies show that the attainment of HL phonology varies according to speakers' background and behaviour, although since they focus on production, which involves articulatory skills, the findings might not be directly applicable to the phonetics of perception.

In bilingualism research, suprasegmental features have not received as much attention compared to segmentals. The acquisition of tones is also relatively understudied, as the most popular L2s (e.g. English, Spanish) do not have tones. Speakers of non-tonal L1s struggle to learn tonal L2s, because they are not habituated to attending to cues relevant to tones (e.g., Halle, Chang, & Best, 2004; Wang, Behne, Jongman, & Soreno, 2004), whereas speakers of tonal L1s have an advantage in acquiring a tonal L2 (Wayland & Guion, 2004). Pierce, Klein, Chen, Delcenserie, and Genesee (2014) also found that children adopted from China, who subsequent to adoption had no exposure to Chinese, recruited the same brain area and displayed similar neural patterns to Chinese-French bilingual speakers when completing a tone discrimination task. Speakers of different languages also attend differently to tonal cues such as pitch height and tone contour

(Fok-Chan, 1974; Tse, 1973), depending on which ones are relevant to their L1. Therefore, speakers who are more sensitive to the relevant cues perceive tones more accurately (Francis, Ciocca, Ma, & Fenn, 2008; Gandour, 1983; Wayland & Guion, 2004).

In summary, HSs often do not acquire the sound system of their HLs to the same level as monolingual speakers, although they out-perform L2 learners. There has also been some research on the factors that contribute to individual differences in HL phonology. However, there are relatively few studies on perception and suprasegmental features such as tones.

3.1.2 Lexical tones in Cantonese

Cantonese is the majority language spoken in Hong Kong and some areas of Guangdong Province and Guangxi Province in China. Varieties of Cantonese are spoken within these regions, but all are mutually intelligible. Lexical tones are used in Cantonese to distinguish words, and in this study they will be referred to by their tone number used in Jyutping, a romanisation system for Cantonese. For example, 丘 *jau1* means 'hill', 柚 *jau2* means 'grapefruit', 游 *jau4* means 'swim', and 有 *jau5* means 'have'.

In Hong Kong Cantonese (HKCAN), there are six lexical tones (see Table 3.1) and three allotones for syllables ending with stops (Bauer & Benedict, 1997). The different tones are distinguished by their relative pitch and contour (Fok-Chan, 1974). For example, the low level tone has a 'low' pitch level relative to other tones, and maintains a 'level' pitch

Tone number	1	2	3	4	5	6
Pitch level	high	mid	mid	low	low	low
Tone contour	level	rising	level	falling	rising	level

Table 3.1 Tones in HKCAN

throughout the duration of the syllable. Most tonemes have multiple meanings, but not all syllables are meaningful in all six tones. In addition, the six tones do not occur with equal frequency. For example, level tones occur more frequently than falling tones, which in turn are more frequent than rising tones (Leung, Law, & Fung, 2004). High tones are more frequent than low tones in the falling and rising contours (Fok-Chan, 1974).

Guangzhou is the capital city of Guangdong Province, so Guangzhou Cantonese (GZCAN) is considered the main variant of Cantonese other than HKCAN. The same tones are used in GZCAN and HKCAN, and the pitch range of different tones is similar across the two variants (Wu, 2006). However, GZCAN differs from HKCAN in that it has two contrastive high tones (high level and high falling), although more recent studies have found that younger GZCAN speakers do not use the high falling tone as often as adult speakers (Bauer, 1998; So, 1996; Wu, 2006). In contrast, while earlier HKCAN speakers used both high level and high falling tones (e.g., Chao, 1947), by the 1990s most of them only used it non-contrastively or not at all (Bauer & Benedict, 1997; So, 1996). The high falling tone was no longer reported in studies of Cantonese acquisition in children (So & Dodd, 1995; Tse, 1991), and so seems to be fading out of

use in HKCAN.[2] Other instances of change in process have also been noted, such as near- or full-merging of Tones 2 and 5 in adult speakers (HKCAN: Bauer, Cheung, and Cheung, 2003; Fok-Chan, 1974; Kei, Smyth, So, Lau, & Capell, 2002; Mok and Wong, 2010; GZCAN: Ou, 2012).

3.1.3 Monolingual acquisition of Cantonese tones

Language-specific tonal categories in Cantonese emerge as early as at 9 months, and the production of tones is generally mastered by age 2 (So & Dodd, 1995; Yeung, Chen, & Werker, 2013). Some studies found that children do not perform at adult-like level until much later (around 9–10 years) (Ching, 1984; Ciocca & Lui, 2003), although it has been argued that the poorer performance of children in these two studies is due to their use of difficult identification tasks that are cognitively demanding and that require knowledge of written forms (Lee, Chiu, & van Hasselt, 2002). Cantonese- and Mandarin-speaking children acquire level tones before contour tones (Li & Thompson, 1977; So & Dodd, 1995), and acoustically similar tones before more distinct tones (Ching, 1984; Ciocca & Lui, 2003).[3] However, the analysis by Ciocca and Lui (2003) found that frequency of occurrence of tone pairs was not related to the order of acquiring tones. These results demonstrate that although tones emerge and can be produced at

[2] Since only the high level tone was tested in this study (paired against the low level tone) and not the high falling tone, any possibility that some speakers in either language group used the high falling tone was not expected to affect the results.

[3] In general, acoustically more similar tones are difficult to distinguish compared to more salient contrasts, for both toddlers and adults (Shi, Gao, Achim, & Li, 2017; So & Best, 2010; Singh, Hui, Chan, & Golinkoff, 2014; Tsao, 2008).

an early age, development continues in later childhood, especially in terms of complex processing of tonal knowledge.

3.1.4 HS acquisition of Cantonese tones

Some studies have examined acquisition of Cantonese tones in HSs, but the results have been contradictory, with some showing that HSs performed similarly to monolinguals, while others showed that HSs were less target-like. J. K.-P. Tse (1978) and S.-M. Tse (1982) are case studies on HSs aged 0;1-2;8, and both showed that young speakers developed similarly to monolinguals, particularly if they receive a high level of Cantonese exposure. Although the participants were living in Taiwan and Australia respectively at the time of testing, they are often used as examples of monolingual development because the input up to the time of study was almost exclusively in Cantonese. Participants in both studies were shown to have mastered the production of Cantonese tones at the same age as reported for monolinguals in the literature. In addition, the order of acquiring tones was also similar to monolingual children's.

However, there are also indications that some tones develop more slowly. For example, Wong (2012), testing Mandarin, found that although HSs aged 3 were acquiring tones in the same order as monolingual peers, they were less accurate in producing some of the tones. Similar delays were reported for Cantonese-English bilinguals in Hong Kong and Mandarin-dominant Cantonese-Mandarin bilinguals in Shenzhen (in mainland

China) (Holm & Dodd, 1999; Law, 2006; Law & So, 2006). Law and So (2006) also found effects of exposure and use on individual speakers' performance. In addition, transfer from the L2 has also been observed, for example with the falling intonation of English statements changing the pitch level of target tones (Law, 2006).[4]

Apart from children, adult HSs also show divergence from monolingual speakers in the perception and production of tones (So, 1999; Mandarin: B. Yang, 2015), although HSs overall perform better than L2 learners (Yang, 2015). Both So and Yang found later AOA to be associated with more monolingual-like performance. The above studies show that HSs, just like non-heritage bilinguals, do not acquire tones in the same way as monolinguals. While some HSs, especially those at a young age, may at first appear to be monolingual-like, their development can diverge from monolinguals' once there is exposure to the majority language. In order to further investigate how tones in HLs are acquired, the present study seeks to answer the following research questions:

1. Do HSs differ from majority language speakers in their acquisition of Cantonese tone discrimination?
2. What factors predict the ability of HSs to discriminate Cantonese tones?

[4] Cantonese also has intonation, but relevant pitch change is applied only to the final tone in a sentence, or is appended to it (Ma, Ciocca, & Whitehill, 2006; Xu & Mok, 2011).

3.2 Methodology

3.2.1 Participants

67 HSs (mean AOT = 8;7, SD = 1;7) were recruited from three primary schools in New York City, who were all taking part in an all-round after-school programme in their schools that was provided by the local Chinese association. The children were identified as speaking predominantly Cantonese at home by the programme staff, which was confirmed by a survey distributed to their parents. Participants' ages are summarised in Table 3.2. The majority of participants were born in the United States (n = 47). Of those born outside the United States, 17 were born in mainland China, three in Hong Kong, and one in Mexico. Age of arrival in the United States (AOA) ranged from 1;6–9;3 (mean = 8;0, SD = 2;2). Apart from Cantonese and English, participants also spoke Mandarin, Taishanese (Hoisanwaa), and Teochew.[5] 26 of the HSs reported being literate in Chinese, which is defined in this study as being able to read and write at least some simple text, and not just a few words. 39 reported never having visited Hong Kong/China, while 28 reported one or more visits.

64 children in Hong Kong (HK, mean AOT = 9;3, SD = 1;10) were tested as a control group. They were recruited from local primary schools and through informal networks. The age of participants is described in Table 3.2. 63 HK participants were born in

[5] Mandarin, Toishanese, and Teochew all have tone systems, but the number of tones in each is different and there is no systematic correspondence with the Cantonese system.

AOT	HS	HK
5-6	1	1
6-7	8	5
7-8	17	9
8-9	9	13
9-10	16	10
10-11	14	11
11-12	2	12
12-13	0	3
Total	67	64

Table 3.2 Age of participants in each language group (n)

Hong Kong, and one was born in China and moved to Hong Kong when he was five months old. 45 participants were taught mostly or always in Cantonese at school, 11 were taught half in Cantonese and English, and nine mostly or always in English. 38 participants reported speaking one or more language(s) other than Cantonese and English, including Mandarin (n = 36).

Children from Hong Kong were selected as controls because like the HSs, they had been exposed to Cantonese from birth and used predominantly Cantonese at home. Both language groups had been exposed to English at an early age, it was the majority language for HSs, while most HK speakers started learning English in kindergarten, and at the very latest when they started primary school.

The family background of both groups of participants was similar. The parents of the participants were all native speakers of Cantonese. Their place of birth is listed in Table 3.3. For HSs, parents used Cantonese on average 83.96% of the time with the participant (SD = 0.21%), while the participants used Cantonese with them 78.54% of the time (SD=

0.24%). For HK speakers, parents used Cantonese with them 85.74% of the time (SD = 0.14%), and participants used Cantonese with their parents 88.87% of the time (SD = 0.13%). There was no difference between the HSs and the control group in terms of proportion of Cantonese use by either parent at home ($p > 0.05$), but the HSs used Cantonese less often than HK participants when speaking with their parents (with father: $t(108.84) = 2.34$, $p < 0.05$, with mother: $t(92.24) = 3.86$, $p < 0.001$). For the purpose of analysis, the proportions of Cantonese used by participants with each parent and vice versa were converted into a single score 'Cantonese experience' by taking the mean of the four measurements (Cronbach's $\alpha = 0.83$)

The parents of both groups rated themselves as highly proficient in Cantonese. These ratings were on a scale of 1–6, with 1 as not being able to understand or speak any Cantonese words, and 6 as being able to understand everything or speak fluently in all situations. On average, parents of HSs scored 5.70 (SD = 0.77) and 5.69 (SD = 0.80) on listening and speaking respectively, while parents of HK participants scored 5.80 (SD = 0.58) and 5.84 (SD = 0.51). There was no difference in self-rating between the two groups of parents ($p > 0.05$).

The HSs were overall younger than the HK participants ($t(129.00) = 2.75$, $p < 0.01$), so in order to remove possible confounding effects for between-group comparisons, age-matched subgroups were formed comprising 53 participants each. The mean age difference between each matched pair was 0.19 years (around 10 weeks), SD = 0.13 (around 7 weeks). The subgroups were used when comparing the two groups, but all

	HS		HK	
	Mother	Father	Mother	Father
Hong Kong	1	4	26	33
(Mainland) China[a]	47	46	14	17
Vietnam	0	1	1	1
Mexico	1	0	2	0
Indonesia	0	0	1	0
Did not respond	20	18	20	13

Table 3.3 Parents' place of birth (n)

[a] Where specified, all in Cantonese-speaking regions.

participants were included for within-group analyses.

3.2.2 Discrimination task

Participants' perception of Cantonese tones was tested using an ABX discrimination task.

3.2.2.1 Stimulus

Two pairs of tones were tested, one with a larger contrast (and therefore easier to distinguish) and one with a smaller contrast. The first pair consisted of Tones 1 (high level) and 4 (low falling). These two tones have different onset pitch and the distance between them increases throughout the syllable, therefore there is a large contrast between them. The second pair of tones consisted of Tones 2 (high rising) and 5 (low rising). Both tones have a low pitch onset and have a rising contour. However, Tone

2 has a steeper gradient and rises to the high pitch level, while Tone 5 has a gentler gradient and ends at a middle pitch level (Yip & Matthews, 2007a). Overall, the two tones were acoustically similar. For the purposes of the present study, the first pair of tones is considered distinct and the second pair is considered similar. Figure 3.1 shows the pitch height and contour of the four target tones, with the distinct pair in Plot A and the similar pair in Plot B. The speech samples used to produce this figure were taken from the stimuli in the task that contained the syllable wai in the respective tones.

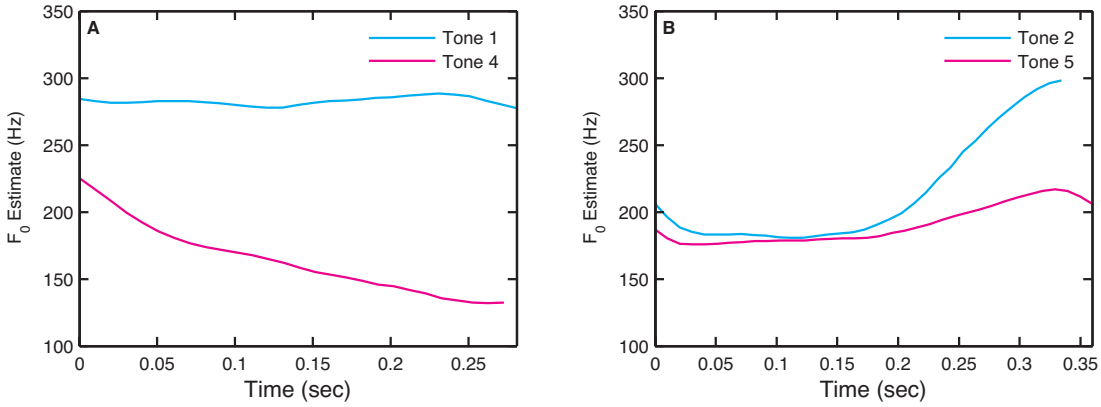

Figure 3.1 Pitch height and contour of target tones

To create the stimuli, the two pairs of tones were combined with two onset-rime combinations, tou and wai, forming a set of four minimal pairs. A control set of stimuli consisted of items contrasting in nucleus and rime, but sharing the same (consonantal) onset and tone, namely /s/ and /l/ in Tones 2, 3, 4, and 5. This resulted in a total of eight pairs of syllables/words. It was ensured that their written forms were included in the 'Hong Kong Chinese Lexical Lists for Primary Learning' (HKSAR Education Bureau, 2008), so that words of low frequency were avoided. Finally, each syllable/word was prefixed with 呀 *aa3*, which is often used in Cantonese names or terms of address. The

eight minimal pairs forming the stimuli set are listed in Table 3.4. The average pitch difference between minimal pairs was 113 Hz for the distinct pair and 24 Hz for the similar pair.

Contrast category	Pairs of stimuli	
Distinct	呀威 *aa3wai1*	呀圍 *aa3wai4*
	呀滔 *aa3tou1*	呀圖 *aa3tou4*
Similar	呀毀 *aa3wai2*	呀偉 *aa3wai5*
	呀土 *aa3tou2*	呀肚 *aa3tou5*
Control	呀手 *aa3sau2*	呀醒 *aa3sing2*
	呀秀 *aa3sau3*	呀勝 *aa3sing3*
	呀林 *aa3lam4*	呀成 *aa3loeng4*
	呀凜 *aa3lam5*	呀兩 *aa3loeng5*

Table 3.4 List of stimuli according to contrast category

3.2.2.2 Procedure

The task was presented using Opensesame (Mathôt, Schreij, & Theeuwes, 2012) on an 8" screen tablet with a pair of headphones. The task was framed as a game, where the participant helped a mother panda find a baby panda. A simple animation showed two baby pandas, one on each side of the screen. In each trial, the baby pandas each presented one item of a stimulus pair, corresponding to stimuli A and B. Afterwards, the mother panda appeared in the middle of the screen with a puzzled look, and presented the target stimulus X. Participants were asked to find the baby panda that the mother panda was calling, by tapping on the correct side of the screen.

The following example illustrates a trial targeting the distinct pair of tones:

(1) First baby panda: 呀威 *aa3wai1*

Second baby panda: 呀圍 *aa3wai4*

Mother panda: 呀圍 *aa3wai4*

Each pair of stimuli was presented twice, with each stimulus targeted once each. Either the left or the right baby panda could present the target stimulus, and the target position (and thereby the order of presentation of items in a pair, since the left baby panda always 'spoke' first) was counterbalanced across target tones. There was a total of 32 trials. The task was presented in four pseudo-randomised lists so that trials did not target the same contrast category consecutively. Two training trials (using a separate set of stimuli) were repeated until the participant provided 100% accurate responses.

3.2.3 Language background questionnaire (LBQ)

Data on participants' language background was collected via a questionnaire for parents written in Chinese, which was distributed at the end of testing. A shorter, oral version was also administered to participants, and their responses were used if their parents' questionnaires were not returned. The questionnaire was adapted from the BiLingual Language Experience Calculator (BiLEC) (Unsworth, 2013), and posed questions concerning children's family background (e.g. date and place of birth, parents' occupation and place of birth), and language background (e.g. Chinese literacy, languages spoken and age of first exposure). Current language use was also measured

by asking for the proportion of Cantonese used between various family members, with teachers and fellow students, and during other activities such as reading and watching TV.

3.2.4 Ethics

Ethical approval for this study was obtained from the Social Sciences Faculty Ethics Sub-Committee, University of Essex. Written consent for children's participation and the use of all collected data was obtained from participants' parents before testing took place.

3.3 Results

Descriptive statistics of participants' scores (as the percentage of responses in which the target baby panda was accurately identified) are shown in Table 3.5. Trials with invalid responses (e.g. if participants tapped on the mother panda) were counted as inaccurate. Performance at chance level was defined in this study as scoring from 40%–60%, and this range was used rather than a 50% cut-off score so as to capture participants who discriminated tones inconsistently. The performance of the two groups with respect to the chance level is summarised in Table 3.6.

The results showed that there were participants from both language groups who reached

a ceiling level of performance (100%), but HSs had a larger range of scores (Figure 3.2). The majority of HSs performed above chance level on the distinct and control categories, and the average was also reasonably high. However, for the similar pair the average score was at chance level, and many HSs scored at or below chance level. All HK participants scored above chance level in all contrast categories. 11 HSs (16% of group) scored below the HK range for the distinct pair, and 28 HSs (42% of group) scored below the HK range for the similar pair. These scores indicate that both language groups were able to complete the task accurately when the difference in stimuli was segmental. However, while HK participants were able to reliably distinguish the two tones in both

Group	Contrast category	Mean	SD	Min	Max
HS	Control	89.65	16.08	31.25	100
	Distinct	80.78	22.75	25	100
	Similar	56.34	21.03	12.5	100
HK	Control	96.88	5.22	75	100
	Distinct	95.12	8.52	62.5	100
	Similar	89.45	12.24	50	100

Table 3.5 Descriptive statistics for scores by language group and contrast category (%)

Group	Contrast category	Above chance	Chance level	Below chance
HS	Control	62 (92.54%)	1 (1.49%)	4 (5.97%)
	Distinct	59 (88.06%)	2 (2.99%)	6 (8.96%)
	Similar	31 (46.27%)	23 (34.33%)	13 (19.40%)
HK	Control	64 (100%)	0 (0%)	0 (0%)
	Distinct	64 (100%)	0 (0%)	0 (0%)
	Similar	64 (100%)	0 (0%)	0 (0%)

Table 3.6 Participants' performance with respect to the chance level (n)

tone pairs, not all HSs were able to do so, especially for the similar tone pair.

Multiple regression analyses were carried out to compare the two groups and to find out which predictors had an effect on scores. Binomial generalized linear mixed models were fitted using the lme4 package in R (Bates, Maechler, Bolker, & Walker, 2015; R Core Team, 2016). Participants were entered as Subject, and the minimal pair tested in each trial as Item, both as random factors. The dependent variable was accuracy on each trial.

Initially, all predictors and interaction terms relevant to each analysis were included in a full model. Predictors are listed in each section below. Non-significant predictors were removed one by one as long as the reduced model provided a better fit for the

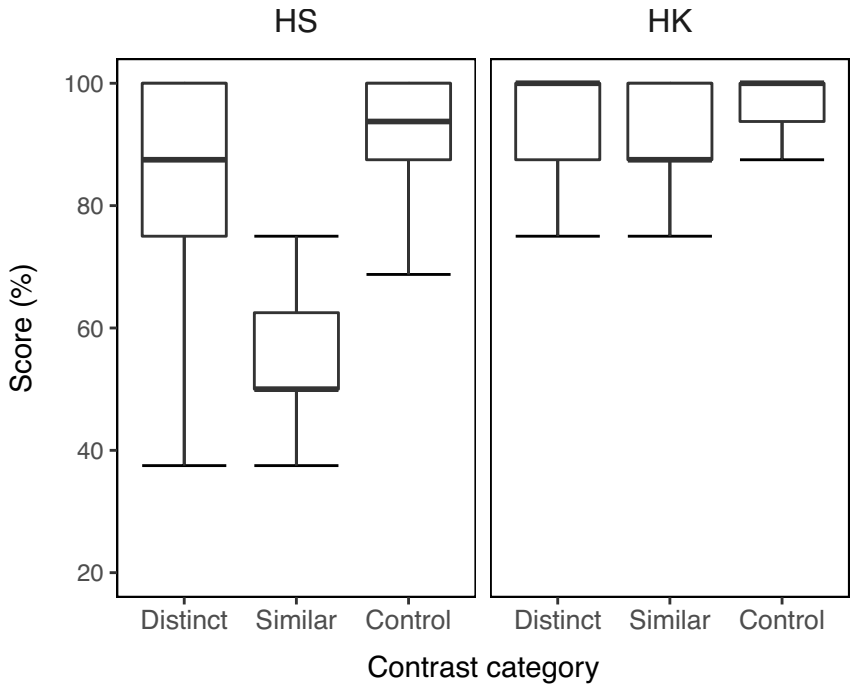

Figure 3.2 Distribution of scores by language group and contrast category

data, and models were compared using AICs and likelihood ratio tests.

3.3.1 Between-group comparison

The first regression analysis compared the two language groups. As described in the methodology section, age-matched subgroups were used for this analysis. Predictors examined included Group and Contrast category (including the Control, Distinct, and Similar levels).

The final model is shown in Table 3.7. The overall model fit was conditional R^2 = 0.22, marginal R^2 = 0.38 (calculated using the piecewiseSEM package in R, Lefcheck, 2015). The negative coefficient estimate of Group indicated that the HSs were less accurate compared to the HK participants. There was also a significant effect of both Group and Category at the Similar level.

	Estimate	Std. Error	z value	p value
(Intercept)	3.75	0.25	15.05	< 0.001
Group	-1.21	0.3	-4.04	< 0.001
Category (Similar)	-1.44	0.26	-5.52	< 0.001
Group:Category (Similar)	-0.77	0.3	-2.57	< 0.05

Table 3.7 Model for between-group comparison

Post hoc Tukey pairwise comparisons (calculated using the multcomp package in R, Hothorn, Bretz, & Westfall, 2008) indicated that the HSs scored lower than the HK participants in all three contrast categories (p < 0.001). Scores of the HSs in both Distinct and Similar categories were lower compared to Control category scores (p < 0.001). In

contrast, the HK participants' Distinct category scores were similar to Control category scores, and they scored lower only in the Similar category ($p < 0.001$).

3.3.2 HSs' performance

Multiple regression analysis was conducted to examine which factors predicted the HSs' performance. The dependent variable was accuracy on trials for the Distinct and Similar categories. Control category trials were not included so as to focus on participants' ability to discriminate tones, and also because individual overall scores for Control category trials were used as a measure of participants' accuracy in completing the task. Predictors examined included the following:

- Age of testing (AOT)
- Gender
- Cantonese experience
- Chinese literacy (see Section 3.2.1)
- Place of birth (United States vs. outside the United States)
- Task accuracy (scores in the Control category)

The final model is shown in Table 3.8. The overall fit was conditional $R^2 = 0.05$, marginal $R^2 = 0.22$.

	Estimate	Std. Error	z value	p value
(Intercept)	-2.41	0.72	-3.33	< 0.001
AOT	0.15	0.06	2.49	< 0.05
Task	2.27	0.61	3.73	< 0.01

Table 3.8 Model for HS scores

The results indicated that older children performed better than younger children, and that there was a significant effect of task accuracy. Cantonese experience, Chinese literacy, and Gender did not have a predictive effect on participants' scores. There was also no effect of Place of birth, and further analysis revealed that with AOT partialled out, there were no significant effects of AOA for participants born outside the United States ($p > 0.05$).

3.4 HK participants' performance

To examine factors affecting scores of HK participants, the same analysis as for HSs was carried out for HK participants. Literacy and Place of birth were excluded as predictors as there was next to no variance in these aspects. The final model is shown in Table 3.9. The overall fit was conditional R^2 = 0.08, marginal R^2 = 0.20. The results indicated that older children performed better than younger children. There was also a significant effect of task accuracy. There was no significant effect of Gender.

	Estimate	Std. Error	z value	p value
(Intercept)	-5.72	2.09	-2.74	< 0.01
AOT	0.17	0.08	2.22	< 0.05
Task	7.18	2.33	3.09	< 0.01

Table 3.9 Predictors for HK scores

3.5 Frequency

Since syllables in Cantonese are not meaningful in all tones, the (in)ability to discriminate between a given pair of tones can be considered relevant only when the syllable in question is meaningful in both tones of the pair; if the syllable is meaningful in only one of the two tones, then regardless of whether the listener can discriminate between the two tones, the same number of words that match the produced sound is available to the listener. To examine whether this could explain the results, the frequency of tonemes that are meaningful in both tones of the target pairs was counted in three sets of data: the Hong Kong Cantonese Corpus (HKCC, Luke & Wong, 2015), as well as the utterances of monolingual children and monolingual adults separately from the Hong Kong Cantonese Child Language Corpus (CANCORP, CHILDES version, Lee et al., 1996). 'Meaningfulness' was determined using 'A Chinese Talking Syllabary of the Cantonese Dialect: An Electronic Depository' (Cantonese Pronunciation Electronic Dictionary Team, 1999), and frequency was calculated using PyCantonese (Lee, 2015). Table 8 shows that there are more words that are meaningful in both Tones 1 and 4 than words that are meaningful in both Tones 2 and 5. Therefore, hypothetical interlocutors would need to discriminate between the Tones 1 and 4 more frequently than between

Tones 2 and 5, which might explain why young children acquire the Distinct contrast earlier than the Similar one.

Tones 1 & 4	Total	Target: Tone 1	Target: Tone 4
CANCORP (children)	29142 (11.45%)	21547 (8.46%)	7595 (2.98%)
CANCORP (adult)	65595 (14.73%)	47550 (10.68%)	18045 (4.05%)
HKCC	17111 (14.26%)	8744 (7.29%)	8367 (6.97%)
Tones 2 & 5	Total	Target: Tone 2	Target: Tone 5
CANCORP (children)	9089 (3.57%)	3701 (1.45%)	5388 (2.12%)
CANCORP (adult)	30047 (6.75%)	12478 (2.80%)	17569 (3.94%)
HKCC	7797 (6.50%)	2431 (2.03%)	5366 (4.47%)

Table 3.10 Frequency of tonemes in CANCORP and HKCC that are meaningful in both tones (percentage of all tonemes in that particular dataset)

3.6 Discussion

In this study, a discrimination task was conducted to examine the acquisition of Cantonese tones in HSs and peers from Hong Kong. Both groups were significantly better at discriminating tones with a more distinct contrast (1 versus 4) compared to more similar tones (2 versus 5). These results were consistent with previous studies showing that similar tones are more difficult to distinguish (e.g., Ching, 1984; Ciocca & Lui, 2003; So & Best, 2010), and showed that acoustic similarity affected tone perception in both the HS and HK groups (Fok-Chan, 1974; Tse, 1973).

Previous research had found that there was no relation between how frequently tone pairs occurred and how well they were discriminated (Ciocca & Lui, 2003). However,

in the present study, where other tone pairs were considered and a different method of calculation was used, support was found for a frequency-based explanation for poorer discrimination, considering three sets of data from two corpora, hypothetical interlocutors would need to discriminate between the distinct pair more often, which could contribute to young children acquiring them before the similar pair. Another manifestation of frequency effects is in that participants may perform better if the stimuli are frequent words and familiar to them. Although only frequent words were used in the stimuli, there was no guarantee that all participants, especially the younger ones, knew all the words. In future studies, each participant's familiarity with words used in the stimuli should be checked with before the discrimination task.

Other than properties of target tones, participants' abilities also played a role in how well tones were discriminated. AOT was a significant predictor for both language groups, indicating that development was ongoing between 5–12 years. These results agree with findings that monolingual children do not achieve adult-like application of tonal knowledge until age 9 or 10 (Ching, 1984; Ciocca & Lui, 2003), and that bilinguals acquired tones slower compared to monolinguals (e.g., Holm & Dodd, 1999; Law & So, 2006). In addition, previous findings that level tones are acquired before contour tones (e.g., Li & Thompson, 1977; So & Dodd, 1995; Tse, 1973) were supported by participants' poorer ability in discriminating between the similar tones (both contour tones). It is also possible that the cognitive load of the task, specifically on memory span and processing, disfavoured younger children (Gathercole, 1998), while older children had

better concentration and were less likely to make mistakes due to fatigue.

3.6.1 The role of input

The HSs scored lower than HK participants in both the distinct and similar contrast categories, showing that early exposure to Cantonese and continued input were not sufficient for the HSs to discriminate tones as accurately as HK speakers. Their Distinct category scores were lower than the Control category scores, showing that the HSs struggled to differentiate tones, even when the contrast was large. In comparison, HK participants only had problems when the stimuli were more similar. This shows that that HSs were less sensitive to pitch differences occurring over a syllable (although it does not mean that they were not sensitive to pitch change at all). These findings were unexpected, as studies have found that children master the basics of tones within the first few years (So & Dodd, 1995), during which HSs were still using predominantly Cantonese). In the following, the findings are discussed in relation to the Cantonese input received by participants, influence from English, and individual differences.

Previous studies have demonstrated that HSs do not all attain monolingual-like phonetic abilities, and how the acquisition of another language can affect the HL (e.g., Godson, 2004; Ronquest, 2013, So, 2000). Since both groups in the current study are bilingual, it is not just bilingualism in itself that separates the two groups. Rather, it is the relative use of each speaker's two languages that is at the root of the difference, a

lower amount of input in the HL is often cited as an important reason why HSs do not attain monolingual-like command of their language (e.g., Montrul, 2008; Rothman, 2009). The HSs in this study (particularly those born in China/Hong Kong) can be conceived as developing effectively like the HK participants in the first few years. The two groups would have been exposed to Cantonese since birth, and since social interaction beyond the Cantonese-speaking family would have been infrequent, they would have been exposed mainly, or even exclusively, to Cantonese. By the same reasoning, J. K.-P. Tse and S.-M. Tse, although ostensibly studying HSs, are often used as examples of monolingual development.

Nevertheless, English is the majority language of the United States, therefore Cantonese use is restricted to the home, the Cantonese-speaking community, or language classes. The start of formal schooling would have increased English exposure, and HSs would use more and more English with their peers at the expense of Cantonese. Since the development of tones continues past the start of schooling, it would be affected in HSs due to lower Cantonese input and use. In contrast, HK participants rely much more on Cantonese in their daily lives, so their tone acquisition was ostensibly not influenced (or influenced to a smaller extent) by the acquisition of English.

Interestingly, the LBQ revealed no difference between the two groups in terms of (current) proportion of Cantonese used by parents at home. The HSs could still have received less input from their parents in absolute terms, since many parents were employed in service or catering positions and probably worked in the evenings. The

current study only used a rough measurement, so using a more detailed questionnaire and also investigating the use of Cantonese by other family members might reveal more about how much Cantonese HSs are exposed to. However, compared to HK participants, HSs used a lower proportion of Cantonese with their parents, which suggests that more production is linked to better perception, although the exact relation remains to be investigated. Possibly, speaking more Cantonese means more opportunities to practice controlling vocal muscles and more opportunities for correction.

Apart from the quantity, the quality of input could also be a source of difference. Previous studies refer to the benefits of a diverse source of HL (e.g., Pascual y Cabo & Rothman, 2012; Rinke & Flores, 2014), such variation is absent for the HSs in the present study, since a large proportion of Cantonese input comes from participants' parents, and there is only a limited number of other Cantonese speakers or range of media in the United States to receive Cantonese input from.

Quality in terms of similarity with the homeland variety can also be considered. If the tones in the input available to HSs differed from that available to HK participants, then the tonal system acquired by the two groups of participants would naturally differ. Sound changes can occur after even a short period of immigration, most commonly due to influence from the new environmental language (Chang et al., 2011; Tse, 2016). Therefore, HSs' parents or other Cantonese speakers may have undergone such change, and provided input to HS participants that differed from the input provided to the HK group. However, this scenario is considered unlikely for the present study. All HSs'

parents were born in Cantonese-speaking regions of China (including Hong Kong) and roughly half immigrated after the birth of their child(ren). Regional variations were inconsequential for the purposes of the present study, therefore it was assumed that tones produced by HSs' parents, up until the time of immigration, were qualitatively similar to HK participants' parents.

Post-immigration, the available evidence suggests that phonological contrasts are maintained in the speech of HSs of Cantonese even into the next generation, although there may be phonetic changes (Chang et al., 2011; Tse, 2016). Studies on L1 attrition in adult immigrants also indicate that typically there is phonetic change but no loss of phonological contrasts (e.g., de Leeuw, Mennen, & Scobbie, 2013). In addition, the parents of HS lived in neighborhoods with high proportion of Chinese residents and businesses, and many had Chinese employers. Therefore, they did not use English frequently, or even had little need to. As such, compared to immigrants who are more isolated or use the dominant language more frequently or even professionally, contact-induced phonological change in HSs' parents in the present study is less probable (Schmid, 2007). As long as tonal contrasts were present in the input, the quality of input was an unlikely reason for the lower scores of HSs. Unfortunately, spoken data from participants' parents was not available.

3.6.2 Influence from English

Interference from the majority language can stimulate phonetic and phonological change (Chang et al., 2011; Godson, 2004), and the SLM (Flege, 1995, 2007) predicts that the sound categories of a bilingual speaker's two languages can change each other, but since English is non-tonal, the categories of Cantonese and English are distinct and should remain dissimilated (Dupoux, Sebastián-Gallés, Navarrete, & Peperkamp, 2008). Although this prediction was not supported by the results, the poor discrimination ability in HS can be viewed as a result of English influence changing the sound categories in Cantonese. Since English intonation and Cantonese tones both rely on pitch height, interaction between the sound categories of the two languages may have led to the construction of non-target-like tone categories, so that HSs may not acquire monolingual-like Cantonese categories for tones to begin with.

Alternatively, HSs' poor performance can be explained by lower sensitivity towards the cues indicating tone in Cantonese. Speakers tend to pay attention to pitch cues that are relevant to their own language(s) (e.g., Wayland & Guion, 2004), so as HSs became more proficient in English, perhaps they also became less sensitive to the onset pitch or contour of each syllable, as these cues are less relevant in English. As a result, HSs attended less to these cues even when listening to Cantonese, so in essence the non-tonal property of English was transferred to Cantonese. Influence might also come from the global intonation patterns and prosodic stress of English sentences, which both rely on pitch height, and therefore compete directly with Cantonese tones. For

HSs, it can be imagined that the application of English intonation might 'flatten out' the production of tones in Cantonese sentences, but to pin the influence of English on tone perception would require further evidence.

3.6.3 Predictors of individual performance

Previous studies have indicated that the acquisition of tones, and in HLs in general, for individual speakers depends on factors that include the amount of HL exposure and AOA (Law & So, 2006; Montrul, 2008; So, 2000; Unsworth, 2013). In the present study, it was found that Cantonese experience, Chinese literacy, and place of birth/AOA all played no role in HS scores. These results suggest that there was no benefit in more contact with Cantonese, whether by using more Cantonese at home, learning Chinese in a formal setting, or living in a Cantonese-majority environment, as far as perceiving tones was concerned. Since phonological development takes place so early and even brief exposure to a language in the early years results in the acquisition of phonological knowledge that persists into later years (e.g., Jusczyk et al., 1999; Oh et al., 2010), it is possible that many HSs in this study had been exposed to the necessary amount of input to acquire Cantonese tones, but that some other factor prevented this from happening (such as influence from English). However, the large range in HSs' scores remains unexplained. AOT and task accuracy had a predictive effect on participants' scores, but they explained only some of the variance. The measure of Cantonese experience used in the analysis reflected both input and output, but since the two groups differed in output

but not input, perhaps a focus on output would lead to different results. There were also other factors that were not examined in this study, including attitude towards the Cantonese language, attitude towards the testing session, language aptitude, memory span, etc. Again, the LBQ administered in this study was a rough instrument and targeted mainly current language use. More detailed measurements of Cantonese and English input and output throughout HSs' lives might reveal more subtle relations between language experience and acquisition.

3.7 Conclusion

The performance of HSs in this study and the comparison with HK participants raises interesting theoretical questions concerning the status of heritage languages and the nature of phonological knowledge. Since HSs enjoyed early and a relatively high amount of exposure to Cantonese at home and in the local community, they may be expected to acquire Cantonese phonology successfully as an L1 speaker or even effectively a monolingual speaker acquiring an early feature. However, not all HSs could discriminate tones like their peers living in a majority language environment.

Given the range of performance by the HSs, more research is needed into factors that predict acquisition of heritage languages. Even if there were attrition effects at work, the net pattern observed in the present study was one of development. However, it is not possible to tell whether the HSs will eventually 'catch up' with the HK participants

based on the available evidence.

Since tone has a phonemic function in Cantonese, poor discrimination skills can affect listening comprehension. Other strategies might have to be used to disambiguate words, such as by depending more on contextual cues. There is not enough evidence to comment on whether there was a merger between Tones 2 and 5 (e.g., Mok & Wong, 2010a), or whether HSs' poorer ability to discriminate tones applies more generally to other contrasts as well. However, if HSs were also to acquire other tones poorly, tonal contrasts may not be fully passed on to the next generation.

Chapter 4

Phonological production in young speakers of Cantonese as a heritage language

4.1 Introduction

4.1.1 Phonological production in HSs

As mentioned in Chapter 3, early exposure to an HL has been hypothesised to bring about advantages in terms of target-like acquisition of the heritage phonology (e.g., Au et al., 2002; Montrul, 2013). However, established sound systems are not necessarily immune to future change, for example as explained by the the Speech Learning Model (SLM, Flege, 1995, 1999), so that the phonological system of either language in a bilingual

speaker will not be similar to a monolingual's.

For HSs, the SLM predicts that the acquisition of the majority language can change the HL sound system to become unlike that of a monolingual acquirer's. The results of some studies have been consistent with such predictions, in that influence of the majority language system was found in the non-target like production of the HL (e.g., Kupisch et al., 2013; Godson, 2004; Ronquest, 2013). Since even short (albeit intense) periods of L2 exposure can lead to phonological change in the L1 for adult immigrants (e.g., Chang, 2012; Sancier & Fowler, 1997), it should be no surprise that HSs' developing/less entrenched systems can develop divergently due to exposure to the majority language. In addition, HSs have fewer opportunities to hear and use the HL in the host society, which may lead to non-target-like acquisition of the HL.

The majority of studies have shown that HSs produce segments significantly differently from monolinguals (e.g., Godson, 2004; Kupisch, Lein, et al., 2014; Oh et al., 2003; Rao, 2015; Ronquest, 2013; Saadah, 2011; but see also Au et al., 2002), and the differences are observed even as early as at preschooler age (Stoehr, Benders, Van Hell, & Fikkert, 2017). However, phonemic contrasts are preserved and the divergence in HSs appears to be only at a phonetic level (Chang et al., 2011; Saadah, 2011; Tse, 2016). In addition, even though HSs are not like monolinguals, they nevertheless outperform late L2 learners, and therefore occupy an intermediary status between the other two populations (Au, Oh, Knightly, Jun, & Romo, 2008; Rao, 2015; Saadah, 2011; but see also Knightly et al., 2003 and Oh et al., 2003), and a similar pattern has been found for production at the

suprasegmental level (Chang & Yao, 2016; Knightly et al., 2003).

On a global level, HSs speak with a more foreign accent in their HL compared to monolingual speakers or bilinguals speaking the same language as a majority language (Flores & Rato, 2016; Kupisch, Barton, et al., 2014). HSs may be particularly aware of their accents, which form an important part of their identities (Lippi-Green, 1997; Jenkins, 2000; Smith & Dalton, 2000). Accents are perceived as a result of judgments on the quality of a speaker's production, for example compared against the listeners' own manner of production, and different accents can exist even for native speakers of the same language/variety (Derwing & Munro, 2009; Jenkins, 2000; Munro & Derwing, 2011). The judgments are made at a phonetic (production of phonemes) or phonological level (e.g. rhythm, accuracy of syllable structure), but (dis)fluency and grammatical and lexical (in)accuracy can also play a role (Harding, 2013; Schmid & Hopp, 2014; Taylor & Geranpayeh, 2011). A 'heritage accent' can result from non-monolingual-like realisation of phonemes or prosodic transfer from the majority language (Rao, 2015). In addition, raters' familiarity with speakers' accents or the particular variety being spoken can affect the range of scores given and raters' confidence in those scores (Flege & Fletcher, 1992; Major, 2007, 2010; Schmid & Hopp, 2014; Thompson, 1991), so the degree of native-likeness of HSs' accents can be perceived differently depending on the raters' experience with HSs.

Another way of qualifying HSs' phonological production is to ask listeners to judge where HSs are from based on characteristics of speech. Chang and Yao (2016) had

predicted that HSs of Mandarin would produce tones more variably, making them difficult for native speakers to identify. Indeed, they found that the HSs were not perceived as a well-defined group demographically, compared to native speakers or L2 learners. Comprehensibility is also relevant to the evaluation of speech quality, but is not often applied to HSs. Comprehensibility refers to listeners' perception of the ease/difficulty in understanding the meaning of an utterance and of how accurately they perceived that meaning (Derwing & Munro, 2009; Jenkins, 2002; Smith & Nelson, 1985). Heavy accents can also decrease comprehensibility, for example when a speaker does not place phonemic word stress accurately and so produces words that are difficult to identify (Munro & Derwing, 1999; Isaacs & Trofimovich, 2012). However, accented speech can also be accurately comprehended in some cases (Derwing & Munro, 2009; Munro & Derwing, 1999), and comprehensibility is not only related to phonology, but also to other aspects of speech, such as vocabulary and fluency.

Although HSs are different from monolinguals as a group, they are not homogeneous in their HL production, and they have received less consistent ratings compared to monolingual speakers in terms of their native-likeness (Flores & Rato, 2016; Knightly et al., 2003; Kupisch, Lein, et al., 2014; Stangen, Kupisch, Lia, Ergün, & Zielke, 2015). There are various factors that lead to variation at an individual level. Speakers with more experience in the HL have been reported as more accurate in their production (Oh et al., 2003; Rao, 2015; Saadah, 2011; Stoehr et al., 2017). A shorter length of residence (LOR) in the host country during childhood, where the HL is the minority language, is

also associated with less native-like accents (Kupisch, Barton, et al., 2014), as earlier arrivals have less experience with the HL overall.

Another factor that has been considered is age, with a later age of arrival (AOA) associated with more native-like accents (Flores & Rato, 2016; Godson, 2004; Oh et al., 2003; Yeni-Komshian et al., 2000). AOA is closely linked to LOR—among a group of peers, AOA is inversely proportional to LOR—and later AOAs signify a longer period of time acquiring the HL in the homeland (as a majority language), which is beneficial for target-like phonological acquisition. Oh et al. (2003) found that even HSs who were exposed to the majority language only after age 5 were more accented compared to those arriving after age 12, suggesting that developed sound systems can be altered in response to input patterns over the course of childhood.

The role of sociolinguistic factors has also been explored. For example, a preference for the HL as opposed to the majority language could result in a more native-like accent in the HL (Kupisch, Barton, et al., 2014). HSs' interlocutors could also play a role, with peers' accents found to be a stronger influence overall than parents' accents, although HSs were also found to be able to maintain some flexibility in their production and emulate their interlocutors' accent to an extent (Chambers, 2002; Khattab, 2009, 2013).

4.1.2 Phonetic and phonological system of Cantonese

So far, there is not a full account of how heritage Cantonese phonology acquired in an English-majority environment may be characterised, but predictions can be made based on the differences between the two sound systems. This section provides a brief comparison of the Cantonese and English phonetic/phonological systems.

In terms of syllable structure, the maximal syllable structure in Cantonese is CVC (Duanmu, 2011), and consonant clusters are uncommon. English has the maximal structure CCCVCCCC (Abercrombie, 1967), and consonant clusters are ubiquitous. The two systems do not include the same set of phonemes. For example, Cantonese lacks voiced stops, but differentiates phonemically between voiceless aspirated and unaspirated stops (e.g. /p^{h}/ vs. /p/ in 爬 *paa4* 'crawl' vs. 爸 *baa4* 'father') (Bauer & Benedict, 1997). In contrast, English has voiced (unaspirated) stops, and the voiceless unaspirated stops exist only as an allophone to the aspirated equivalent (e.g. /t/ in stay [steɪ] vs. tail [t^{h}eɪl]). In addition, Cantonese is syllable-timed and does not use vowel length contrastively (Chan, 2000; Kao, 1971), while English is stress-timed and differentiates between long and short vowels.

At the suprasegmental level, Cantonese uses tones, which are differentiated by their relative pitch (high, mid, low) and contour over a syllable (e.g. rising, falling, level). (Cantonese tones are described in more detail in Section 3.1.2, p. 72). On the other hand, English has no tones, but uses pitch change in intonation, where global pitch change

(i.e. over an utterance) conveys an emotional/attitude state or signals grammatical structure (e.g. falling intonation for statements and rising for questions). Intonation is also used in Cantonese, but it plays a less important syntactic role compared to in English. Tones tend to retain their features even with intonation (Fry, 1968; Matthews & Yip, 2011). For example, the rising intonation of questions is optional or confined to the final syllable (Chow, 2002).

The different varieties of Cantonese, while mutually intelligible and largely identical, differ noticeably especially in phonology. For example, the alveolar consonants /s/, /ts/, and /ts^h/ are produced in a more palato-alveolar manner by speakers of HKCAN (Bauer & Benedict, 1997; Cheung, 2002). Due to the social and linguistic separation between Hong Kong and the other Cantonese-speaking regions when Hong Kong was under British rule, overall the varieties spoken in Guangzhou and in the surrounding region are more similar to Guangzhou Cantonese (GZCAN) than Hong Kong Cantonese (HKCAN). Some of the phonetics differences have been attributed to the influence of English on HKCAN (Ding, 2010), as opposed to Mandarin influence in GZCAN (Ou, 2012). However, recent studies have noted that there is ongoing change in both varieties, and that some differences recorded in earlier studies were no longer found in younger speakers (Bauer & Benedict, 1997; Wu, 2006).

4.1.3 Production of Cantonese in HSs and other bilingual speakers

Little is known about whether HSs of Cantonese speak it with an accent, but research in their phonetic production indicates that they produce Cantonese differently compared to monolinguals (Leung & Goad, in prep.; So, 2000; Holm & Dodd, 1999), which could lead to a perceived accent. So (2000) studied adult speakers of Cantonese living in Canada, who were divided into three groups depending on when they immigrated: in childhood, adolescence, or adulthood. The last group had been living in Canada for less than 2 years at the time of testing, and was used as a control group. While there was no difference between the three groups in vowel duration, both HS groups showed reduction in tonal space,the relative distance between tones was smaller, especially at the top of the tonal space, which affected the contrast between the rising tones. So suggested that the influence of English phonology led to such a divergence in HSs. In addition, the group that moved during adolescence was more similar to the control group while the group that moved in childhood was more different, indicating an effect of AOA.

Influence from English was also observed in Holm and Dodd (1999), who studied two children aged 2;3–3;1 and 2;9–3;5 living in Australia (AOA 6 and 18 months respectively). The transfer was not direct, however, for example, phonemes used in only one language did not appear when the other language was spoken. There were developmental processes not observed in monolinguals. For example, the two children showed final

consonant deletion in Cantonese, even though final consonants in Cantonese have a high functional load and are therefore seldom deleted during development. Deletion is typical in English, thus demonstrating the effect of acquiring a language in addition to Cantonese.

Leung and Goad (in prep.) studied tone merging between Tones 4 and 6 (low falling and low level) in HSs living in Toronto, and showed merging in both HSs and adult immigrants who moved to Canada after age 18. The extent of merging varied with tonal context and gender of speaker, but no other sociolinguistic factors (including ethnic orientation and language use) predicted the merger for the HSs. Unlike So (2000), no transfer from English intonation was found. There is tonal merging in the production in adult speakers of both HKCAN and GZCAN in the homeland (e.g., Mok & Wong, 2010b; Ou, 2012), however HS children are less accurate in discriminating Cantonese tones compared to majority language peers (see Chapter 3), therefore while there may be ongoing changes in the Cantonese phonological system that is not related to any minority status, at the same time HSs may diverge in other ways that set them apart.

(Non-heritage) bilingual speakers have similarly shown non-monolingual-like production. Law (2006) studied English-Cantonese bilingual children aged 1;08–3;00 who were dominant in English, and observed English-like prosody when the children spoke Cantonese. For example, there were larger pitch differences between disyllabic Cantonese words, potentially imitating the falling intonation of English statements. Unfortunately, there are no relevant studies on adult learners of Cantonese as far as the

author is aware.

4.1.4 Research questions

Previous research has shown that HSs' production differs from that of monolinguals, in some cases as a result of interaction with or direct influence from the majority language. Specifically for Cantonese, research has shown that HSs are unlike monolinguals at a phonetic level, but it is unclear whether such differences can be perceived by other speakers at a global level. Therefore, the current study examines the production of young HSs by comparing them to a control group of children living in Hong Kong, who are also Cantonese-English bilinguals like the HSs, but for whom Cantonese is the majority language.

The first research question asks whether the HSs' perceived accent and comprehensibility were comparable to the control group's, as judged by adult speakers from Hong Kong. The second question investigates whether the two groups were similar in terms of where they were perceived to be from. This classification serves as a third measure of their phonological production, and as there exist differences between the different varieties of Cantonese (e.g. HKCAN vs. GZCAN), the results could also be used to evaluate whether raters would consider production characteristic of Cantonese varieties other than their own as native-like. Finally, the third research question investigates the role of different language background factors in predicting native-likeness and

comprehensibility in the HSs. The research presented previously has found that factors including the amount of HL experience and AOA predict more target-like production, and the current study seeks to identify their effects in Cantonese HSs.

4.2 Methodology

4.2.1 Participants

Ethical approval for this study was obtained from the Social Sciences Faculty Ethics Sub-Committee, University of Essex. Written consent was obtained from the parents of all children under age 16 and from all adult participants.

4.2.1.1 Speakers

51 HSs took part in this study. They were all living in areas of New York City with a high proportion of Chinese residents. The criterion for taking part was that they used predominantly Cantonese at home, which was confirmed through an initial survey to their parents. The HSs' age of testing (AOT) ranged from 5;7–11;00 (mean = 8;7, SD = 1;7). The group included 22 male and 29 female participants. All parents of the HSs were native speakers of Cantonese (parents' place of birth is listed in Table 4.1). 34 of the HSs were born in the United States, with 25 specifying that immigration took place in their

	HS		HK	
	Father	Mother	Father	Mother
Hong Kong	2	1	5	4
(Mainland) China	35	36	3	4
Vietnam	1	-	-	-
Mexico	-	1	-	-
n/a	13	13	4	4

Table 4.1 Speakers' parents' place of birth

parents' generation. Of the 17 HSs born outside the United States, three were born in Hong Kong, 13 in mainland China (all in Cantonese-speaking regions where specified), and one in Mexico. For these 17 participants, AOA ranged from 1;6–7;11 (mean = 4;3, SD = 2;2), and LOR from 1;4–10;11 (mean = 4;11, SD = 2;7). All the HSs were attending local (English-speaking) primary schools. Apart from Cantonese and English, some HSs also reported speaking Mandarin, Taishanese (Hoisan-wa), and Minnan/Hokkien, or were learning French or Spanish at school. 14 reported taking Chinese language classes, with six studying in Cantonese, seven in Mandarin, and one in both Cantonese and Mandarin. However, a total of 21 HSs reported being literate in Chinese (here defined as being able to read and write some simple text, and not just a few words), as some HSs were taught to read Chinese at home.

12 children in Hong Kong (HK) were tested as a comparison group. Like the HSs, they had been exposed to Cantonese from birth and used predominantly Cantonese at home, as Cantonese is the majority language of Hong Kong. Since English is taught in schools, the participants had also been exposed to English early on—the latest by kindergarten.

There were four boys and eight girls, with AOT 5;3–11;4 (mean = 8;4, SD = 1;10). All 12 children were born in Hong Kong to native Cantonese speaker parents (parents' place of birth is listed in Table 4.1). All were attending local primary schools, with nine taught mostly in Cantonese, one mostly in English, and two in an equal mix of English and Cantonese. Although more data had been collected, only 12 HK speakers best matching the AOT of the HSs were included in the present study so as to shorten the rating task, reduce rater fatigue, and avoid any range effects caused by potential non-nativelikeness in the HSs (cf. Flege & Fletcher, 1992; Hopp & Schmid, 2013).

Both groups of participants had parents with high self-rated Cantonese proficiency. On a scale of 1–6, with 1 as not being able to understand or speak any Cantonese words, and 6 as being able to understand everything or speak fluently in all situations, parents of both groups scored above 5.50 on average for both listening and speaking. The HSs' parents scored 5.85 (SD = 0.39) and 5.82 (SD = 0.53) on listening and speaking respectively, while the HK participants' parents scored 5.60 (SD = 1.10) and 5.60 (SD = 0.97) respectively. Mann-Whitney tests showed that there was no difference in the self-rated proficiency between the two groups of parents ($p > 0.05$).

Cantonese was the main medium of interaction at home for both groups. Table 4.2 shows the average proportion of Cantonese used by the participants with their parents and vice versa. Both Cantonese and English were used at home, but generally, Cantonese was used more frequently for both groups of participants. The difference between the HSs and the control group in terms of Cantonese use by both parents and children was

low, and there was no significant group difference on any of the four measurements (ps > 0.05). However, the two groups differed in that the HSs were mainly exposed to GZCAN or varieties closer to it, as most of them or their parents were from Cantonese-speaking parts of mainland China. On the other hand, the control group and the raters were speakers of HKCAN.

	HS		HK	
	Mean	SD	Mean	SD
Father's use with child	86.98	21.26	87.5	17.68
Mother's use with child	82.29	23.61	85.42	19.82
Child's use with father	82.14	26.02	85.00	12.91
Child's use with mother	78.06	25.84	83.33	19.46

Table 4.2 Proportion (%) of Cantonese use between participants and their parents

4.2.1.2 Raters

30 adult first language speakers of HKCAN were recruited as raters. They had all grown up and studied in a HKCAN-majority environment, and none of them had received any specific phonetic training or were teachers of Chinese. All were proficient in English, and they also had varying levels of proficiency in Mandarin.

Ideally, all raters and speakers should speak the same variety of Cantonese in order to avoid confounding effects on raters' judgments. However, in this study it was not possible to include raters to account for all the different varieties of Cantonese spoken by the two groups of participants and their parents. Therefore, only speakers from Hong Kong were recruited as raters. The raters would have some familiarity with

GZCAN (and other varieties of Cantonese) even if they did not speak it, as there are many workers, students, and tourists from mainland China in Hong Kong. However, it was ensured that raters did not speak another Chinese dialect or used Mandarin regularly, so as to maintain a certain uniformity within the rater group.

12 of the raters had recent immersion in an English-dominant environment, as they were either currently studying in the UK or had returned to Hong Kong from their studies within the last two years. However, it was ensured that these raters had not arrived in the UK prior to post-secondary education, so these raters were assumed to have acquired Cantonese in the same way as the other 18 raters. Whether the English exposure during adulthood from overseas studies has an effect on the ratings given is explored in the Results section (Section 4.3.3, p. 121).

4.2.2 Materials

4.2.2.1 Language background questionnaire

A language background questionnaire (LBQ) was distributed to the speakers' parents in order to collect information concerning the children's use of different languages in different contexts. The questionnaire was adapted from the BiLingual Language Experience Calculator (BiLEC) (Unsworth, 2013), from the original oral form to a written survey in Chinese. A shorter, oral version of the questionnaire was administered to the

children participants at the end of testing, in either English or Cantonese according their preferences. (All the HSs chose English and all the HK participants chose Cantonese.) In a few cases (n = 7) where the HSs' parents did not return the LBQ, the children's responses were used instead.

4.2.2.2 Rating task

Free speech was elicited from the speakers by a story-telling task using the 'Frog, Where Are You?' picture book (Mayer, 1969). A sample of 10–15 seconds was extracted from each speaker's recording for the rating task. Only complete utterances were included in the samples, and utterances containing non-Cantonese words were excluded. Following de Leeuw, Schmid, and Mennen (2010), silent pauses of longer than one second were cut to one second. Hesitations and false starts were removed from samples. Some HSs did not produce enough error-free utterances to make up a long-enough sample, so some samples contained minor mistakes. Therefore, some mistakes were deliberately included in samples for HK participants, in order to control for any effects of grammatical mistakes of the raters' judgments. Table 4.3 lists the number of mistakes included in the samples. All mistakes (for both groups) involved the use of an inappropriate classifier, except for one case of classifier omission and one instance of inaccurate preposition use (both by HSs). Noise reduction and volume normalisation was performed for all samples.

There was a total of 67 samples, which were presented in two pseudo-randomised lists. Raters listened to each sample once, and answered three questions about each sample. The first question was 'How native-like does this speaker sound?', and assessed raters' impression of speakers' accents. Ratings were given on a scale of 1 ('completely native-like') to 5 ('not native-like at all').

The second question was 'How well did you understand what this speaker was saying?' Ratings were given on a scale of 1 ('extremely well') to 5 ('not well at all'). This question targeted comprehensibility, and tested how difficult the raters found it to understand the samples.

The third question was 'Where do you think this speaker is from?' The options included:

(a) Hong Kong

(b) Cantonese-speaking parts of China (e.g. Guangzhou, Shenzhen)

(c) Non-Cantonese-speaking parts of China (e.g. Beijing)

(d) Overseas (e.g. United States)

	No. participants	
No. mistakes	Hs	HK
0	32	6
1	8	0
2	6	6
3	3	0
4	1	0
5	1	0

Table 4.3 Number of mistakes in the participants' samples

The rating task was administered using Qualtrics. The raters' linguistic background was confirmed during recruitment to ensure they had been born and raised in a HKCAN-majority environment, and they also gave written consent and completed a short background questionnaire before the start of the study. They were paid for their participation.

4.3 Results

4.3.1 Native-likeness

A score for each speaker's perceived native-likeness was calculated by taking the mean for all 30 raters' scores on Question 1 of the rating task. The ratings had been given on a scale of 1–5, with lower scores indicating more native-like production. Inter-rater reliability was high (α = 0.92). The HSs received an average score of 3.16 (SD = 0.74), and they had a large range of scores (1.73–4.67), with some perceived to be almost not native-like at all (i.e. close to 5) (Figure 4.1, Plot A). In comparison, the HK participants scored higher on average (mean = 2.23, SD = 0.64). They were not all rated at the maximum level of native-likeness, although individual speakers came close (i.e. scored close to 1). They also had a larger range of scores (1.13–2.83).

Multiple regression analyses were conducted to compare the scores of the two language groups. Linear mixed models were fitted using the lme4 package (Bates et al., 2015) in R

(R Core Team, 2016). Random factors included Subject, Rater, and Number of mistakes. The dependent variable was the score given by each rater. The fixed factors included the following: participant Group, to test the difference between the HSs and the control group; AOT, to find out whether scores changed with age; and Gender, to find out if raters perceived speech produced by the genders differently. The interaction of Group with each of the other fixed factors was also tested. The final model was selected by first including all predictors in a full model, then removing non-significant predictors one by one to obtain a model with a better fit. Models were compared using AICs and likelihood ratio tests. The estimates (standardised coefficients) of the fixed effects were used as measures of effect size.

The final model is shown in Table 4.4. The results showed that the HSs were rated as significantly less native-like than the HK participants. There was no predictive effect

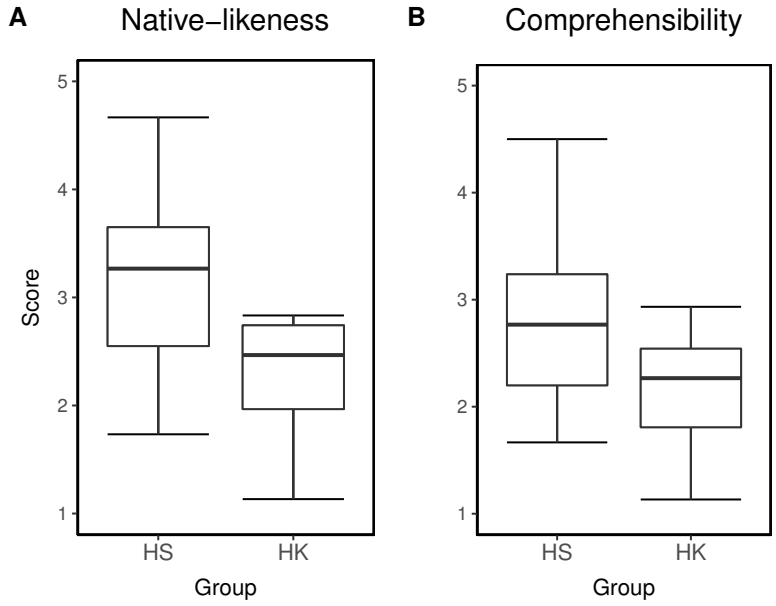

Figure 4.1 Each group's scores for perceived native-likeness and comprehensibility

of AOT, Gender, or any tested interaction on native-likeness scores (ps > 0.05). The overall model fit was conditional R^2 = 0.40, marginal R^2 = 0.08 (calculated using the piecewiseSEM package in R, Lefcheck, 2016).

	Estimate	Std. Error	df	t value	p value
(Intercept)	2.14	0.31	12.5	6.93	< 0.001
Group	1.16	0.22	60.2	5.18	< 0.001

Table 4.4 Model for native-likeness scores

4.3.2 Comprehensibility

A score for each speaker's comprehensibility was calculated by taking the mean for all 30 raters' scores on Question 2. The ratings had been given on a scale of 1–5, with lower scores indicating better comprehensibility. Inter-rater reliability was high (α = 0.925). The HSs received an average score of 2.78 (SD = 0.68), and they had a large range of scores (1.67–2.50), with some perceived to be almost not native-like at all (i.e. close to 5). In comparison, the HK participants scored 2.16 on average (SD = 0.58), with a smaller range of 1.13–2.93 (Figure 4.1, Plot B).

The two groups of speakers were compared using multiple regression, with the same parameters as the analysis on native-likeness. The final model is shown in Table 4.5. The results showed that the HSs were rated as less comprehensible than the HK participants. There was no predictive effect of AOT, Gender, or any tested interaction on comprehensibility scores (ps > 0.05). The overall model fit was conditional R^2 = 0.40,

marginal R^2 = 0.05.

	Estimate	Std. Error	df	t value	p value
(Intercept)	2.07	0.28	11.1	7.35	< 0.001
Group	0.79	0.21	60.28	3.79	< 0.001

Table 4.5 Model for comprehensibility scores

Finally, there were strong correlations between the native-likeness and comprehensibility scores, for both the HK group (r = 0.92, p < 0.001) and the HS group (r = 0.84, p < 0.001).

4.3.3 Raters' English immersion

As mentioned in the Methodology section, 12 of the 30 raters had recent immersion in an English-dominant environment. Previous research suggests that immersion in an L2 environment can lead to phonological change in the L1 even after only a short period of stay, and that immigrants' perception of native-likeness/foreignness—particularly when listening to non-native speech—can also undergo change (Chang, 2012; Major, 2010). Therefore, it was possible that the 12 raters would give different ratings compared to the other 18. To investigate, scores given by raters with recent immersion ('Immersion') were compared to scores given by raters with no recent immersion ('No immersion'). The descriptives for the scores given are shown in Table 4.6. Multiple regression analyses indicated that there was no significant effect of raters' English immersion on ratings given to either group of speakers, on either measure (ps > 0.05).

		Immersion		No immersion	
		Mean	SD	Mean	SD
HS	Native-likeness	3.09	0.71	3.2	0.79
	Comprehensibility	2.71	0.66	2.83	0.72
HK	Native-likeness	2.09	0.64	2.32	0.67
	Comprehensibility	2.1	0.62	2.19	0.57

Table 4.6 Ratings given by raters with and without recent English immersion

4.3.4 Predictors of HSs' scores

Multiple regression analyses were conducted to find out whether any linguistic background factors predicted HSs' accent ratings and comprehensibility respectively. The factors tested were AOA, Cantonese experience, and Chinese literacy. Cantonese experience was a score for Cantonese input and output at home, and was obtained by taking the mean of the four measurements for participants' proportion of Cantonese use with each parent, and vice versa (α = 0.89).[6] The results showed that for both native-likeness (Table 4.7) and comprehensibility (Table 4.8), none of the tested predictors had a significant effect (ps > 0.05).

	Estimate	Std. Error	df	t value	p value
(Intercept)	3.01	0.59	39.56	5.06	< 0.001
AOA	0.05	0.05	38	0.9	0.37
Experience	-0.03	0.56	38	-0.05	0.96
Literacy	0.04	0.24	38	0.16	0.87

Table 4.7 Predictors of HSs' accent ratings

[6] Age of first exposure to English was not included as the data appeared unreliable: taking the parents' responses with regards to age of first exposure to Cantonese and English (and any other language if noted), some of the HSs were not exposed to any language until a few years from birth.

	Estimate	Std. Error	df	t value	p value
(Intercept)	2.59	0.56	39.3	4.64	< 0.001
AOA	0.05	0.05	38	0.97	0.34
Experience	-0.2	0.53	38	-0.38	0.71
Literacy	0.18	0.23	38	0.81	0.42

Table 4.8 Predictors of HSs' comprehensibility

4.3.5 Where speakers were perceived to be from

Question 3 of the rating task required raters to choose where they perceived each speaker to be from. Table 4.9 shows the number of votes received for the different options. The HSs received roughly the same number of votes for Guangzhou and the United States, followed by Hong Kong, then Beijing. This indicates that the HSs were more commonly perceived to be either coming from a GZCAN background or from overseas with an English background. There were fewer votes for a HKCAN background, and the least common option was a Mandarin-speaking background. The HK speakers were clearly judged to be from Hong Kong, with Hong Kong receiving the majority of votes. The rest of the votes were more or less evenly split between the other options.

	HS		HK	
	No. votes	(%)	No. votes	(%)
Hong Kong	363	23.74%	217	60.28%
Guangzhou	458	29.95%	53	14.72%
United States	439	28.71%	46	12.78%
Beijing	269	17.59%	44	12.22%
n/a	1			

Table 4.9 Votes for where speakers were perceived to be from

Table 4.10 lists the descriptives of scores for native-likeness and comprehensibility for the two groups of speakers, with sub-groups based on where each rater had categorised them to. Raters gave the most favourable scores to the speakers that they perceived to be from Hong Kong, followed by Guangzhou, followed by Beijing and the United States. The pattern of ratings given was the same regardless of which language group the speakers actually belonged to, which suggests that the raters, themselves HKCAN speakers, used HKCAN as their standard of judgment.

		Native-likeness		Comprehensibility	
		Mean	SD	Mean	SD
HS	Hong Kong	1.43	0.77	1.98	1.18
	Guangzhou	2.66	0.98	2.62	1.11
	United States	3.54	1.00	3.29	1.25
	Beijing	3.70	1.13	3.33	1.18
HK	Hong Kong	1.26	0.62	1.67	0.83
	Guangzhou	3.04	1.27	2.92	1.05
	United States	3.98	1.11	4.09	1.29
	Beijing	4.20	1.05	4.07	1.17

Table 4.10 Mean scores given to speakers grouped by where they were assigned to

4.3.6 Qualitative analysis

Since the quantitative analysis did not reveal any significant predictors of the HSs' scores, a qualitative approach was taken to further explore the question. The three HSs with the highest native-likeness and comprehensibility ratings were compared to the three with the lowest ratings. The ratings received by these HSs and details on their

language background can be found in Table B.1, Appendix B.1, p. 229. The first group (HS1–3) was perceived to be from Hong Kong, even though they were all born in the United States. In fact, even though the parents of speakers HS1 and HS2 were born in China, these two speakers were perceived to be sufficiently native-like (according to the HKCAN raters) to be assigned to Hong Kong. The parents of HS3 were born in Hong Kong, and the ratings that she received suggest that she was converging on Cantonese as spoken by her parents. In contrast, the second group (HS4–6) was all perceived to be from a non-Cantonese background (United States or Beijing).

The language background of these two groups was broadly similar, and there was no clear distinguishing factor. For example, both groups of speakers had parents with equally high self-rated Cantonese proficiency. However, while none of the HSs with lower ratings were literate in Chinese, two of three HSs with higher ratings had a certain degree of Chinese literacy. Judging solely from Table B.1, it also appears that a late AOA could negatively affect perceived native-likeness, which is inconsistent with previous evidence (e.g., Oh et al., 2003). Speaker HS6 was born in Hong Kong and did not immigrate until 5;5, and therefore should have received more Cantonese exposure than the other HSs or attended preschool in Hong Kong. Nevertheless, she was rated with low native-likeness and comprehensibility and most of her votes were for Beijing.

The samples used in the rating task were also examined to find out whether any characteristics of the HSs' production led to the difference in ratings. The speakers with higher ratings made fewer (grammatical) mistakes, and produced longer sentences and

slightly more words per second (Table B.2, Appendix B.1, p. 229). The transcripts of the samples (Appendix B.1, p. 233) also show that speakers with higher ratings used more discourse linkers such as 咁 *gam2* ('so', 'then') and 跟住 *gan1zyu6* ('and then', 'after that'). All of the above could have given an impression of more fluent and proficient speakers. In terms of vocabulary, the raters may have noted the use of 講 *gong2* by HS5 to mean 'to say', as HKCAN speakers might use instead 話 *waa6* to report speech.

From the samples, it was observed that the speakers with low ratings produced certain words unlike how HKCAN speakers would produce them. Since the raters were HKCAN speakers themselves, the different pronunciation could explain why low ratings were given. Noticeably, no such differences were observed for speakers with high ratings. Table 4.11 compares the HKCAN pronunciation to the phonetic transcription of the words using IPA that were produced in a non-HKCAN way.

The comparison shows that the main divergences in the speakers' production lay with the tone or the vowel. In terms of consonant, the [t͡ɕ] produced by HS5 does not exist in (HK)CAN. HS6's case was one of assimilation, where the velar nasal [ŋ] at the end of the previous word was carried onto an unvoiced velar plosive [k] at the onset of the following word (2).

(2) Target word: 青蛙 “frog”

IPA: $\widehat{ts^h}ɪŋ^{55}wa^{55}$ → $\widehat{ts^h}ɪŋ^{55}k^wa:^{55}$

jyutping: *cing1waa1* *cing1gwaa1*

Speaker	Target word	Speakers' production (IPA)	HKCAN pronunciation (IPA)	HKCAN pronunciation (jyutping)	Locus of difference
HS4	佢	$k^{hw}ɔi^{13}$	$k^hɵy^{13}$	*keoi5*	vowel
	娃	$wa:^{21}$	$wa:^{55}$	*waa1*	tone
	味	mei^{21}	mei^{13}	*mei2*	tone
HS5	咁	$ka:ŋ^{35}$	$kɐm^{35}$	*gam2*	vowel
	青	$\widehat{tɕ}ɪŋ^{55}$	$\widehat{ts^h}ɪŋ^{55}$	*cing1*	consonant
	去	hey^{35}	hey^{33}	*heoi3*	tone
HS6	狗	$kɐu^{55}$	$kɐu^{35}$	*gau2*	tone
	娃	$k^wa:^{55}$	wa^{55}	*waa1*	consonant
	條	$t^hia:u^{21}$	$t^hi:u^{21}$	*tiu4*	vowel

Table 4.11 Comparison of speakers' production to HKCAN pronunciation

4.4 Discussion

In this study, the phonetic and phonological production of young HSs of Cantonese was investigated, and monolingual peers in Hong Kong served as a control group. Monolingual adult speakers rated the speakers' production in terms of perceived native-likeness and comprehensibility, and they also classified the speakers according to where they were perceived to be from.

Overall, the HK group received high ratings for native-likeness and comprehensibility, but the HSs were perceived to be less native-like and less comprehensible in comparison.

The HK participants were reliably judged to be from Hong Kong, while the HSs were not clearly classified to any one place. The results for the HSs are consistent with previous research that showed non-native accents in HSs of other languages (e.g., Kupisch, Barton, et al., 2014). The qualitative results also revealed non-target-like production of consonants, vowels, and tones in the HSs, which could have contributed to the non-native accents. Previous research had found non-monolingual-like production at the segmental level in HSs (e.g., Godson, 2004; Oh et al., 2003), therefore a global accent would have resulted from non-target-like production of the smaller units of speech (Rao, 2015), even if divergences do not occur for all segments (e.g., Au et al., 2002),

Comprehensibility refers to how easy or difficult a listener finds it to comprehend an utterance (Derwing & Munro, 2009; Jenkins, 2002). The current study did not investigate what features of speech impacted comprehensibility, but past research suggests that listeners find samples containing grammar and vocabulary mistakes more difficult to understand (Isaacs & Trofimovich, 2012). However, these issues may have played a less important role in the current study. On a grammatical level, the proportion of samples containing grammatical mistakes was balanced across the two groups. Since the participants tended to produce only short and simple utterances, complex structures that participants might struggle more with were used infrequently. In terms of vocabulary, the only notable divergent use in all 51 samples was the use of 講 *gong2* for 'to say', but it was sufficiently similar to the target word that comprehension should not have been affected. Native-likeness was highly correlated with comprehensibility, so at least in

this study, phonetic divergence was strongly related to the HSs' low comprehensibility scores.

4.4.1 Divergence in HSs

While HSs cannot be expected to be monolingual-like in their phonetic production (cf. SLM), the divergence of the HSs from the control group in this study was not only due to bilingualism in itself, as both groups were Cantonese-English bilinguals who were exposed to Cantonese from birth and then to English between birth and the start of schooling. Since the Cantonese sound system of both groups could be altered by the acquisition of English sounds, the different outcomes in production could be interpreted as resulting from different extents of English influence: since English was the majority language for the HSs, they most likely received less input in Cantonese compared to the HK group but used English more often, both at the time of testing and accumulated from birth (Unsworth, 2013). A more frequently-used majority language could have a stronger influence and change the HL sound system to a larger extent, or in a different way. For example, assimilation could occur more often from an HL sound into a majority language equivalent, rather than in the opposite direction. Consequently, a HS would be perceived to speak the HL with a non-native-like accent. Interestingly, the LBQ data revealed no differences in proportion of Cantonese input from parents between the two groups, possibly because the HSs had been selected with the criterion that Cantonese was used predominantly at home. The comparison might have differed if

the two groups were compared on the actual amount of HL input received, such as by including also the input from siblings, school friends, etc.

Differences in the quality of Cantonese input can also explain the differences between the two groups. The HSs may be receiving input that is unlike the variety spoken in the homeland, such as from input providers who had undergone attrition or acquired Cantonese in a heritage context (Chang et al., 2011; Sorace, 2004), or other Chinese immigrants who were not L1 speakers of Cantonese (e.g. speaking Fuzhounese or Mandarin as an L1). In other words, the young HSs may have acquired their accents from the accented speech of those around them. The quality of input could also be mixed. For example, a parent who does not need to use English very often may undergo little Cantonese attrition and speak with an accent similar to that of homeland speaker, while siblings and peers growing up in the United States may have less target-like accents.

The two groups of speakers may have come from backgrounds of different Cantonese varieties anyway, and the classification task showed that there was bias in the HKCAN-speaking raters when judging the samples. The raters gave lower scores to speakers judged to be from a GZCAN background, compared to speakers from Hong Kong, but most of the HSs' parents (and many of the Chinese residents in New York) came from mainland China and spoke GZCAN or a Cantonese variety more similar to GZCAN. Even if the HSs had been 'target-like' in terms of having an accent similar to their parents', they might be disadvantaged from by the raters' preference for accents more

similar to their own (e.g., Flege & Fletcher, 1992; Major, 2007, 2010; Schmid & Hopp, 2014; Thompson, 1991).

The results of this study show that target-like production does not necessarily follow from early exposure. Even if HSs initially went through a period of predominantly Cantonese exposure as they interacted mainly with family members in infancy, their Cantonese production was unlike the majority language speakers' when tested in later childhood. One reason could be that while sound systems emerge early, they are not stabilised until much later—for example after HSs start using the majority language—or that even if they are fully acquired, they are susceptible to change throughout a speaker's lifetime. After all, research on phonetic attrition in adult immigrants (e.g., de Leeuw et al., 2010) indicates that phonological systems in even adults can undergo change. Even if the HL sound system had been acquired by the time of first exposure to the majority language, it is unlikely to be impervious to change. In addition, phonetic production appears to change within a relatively short period in response to different input (Chang, 2012; Sancier & Fowler, 1997). Therefore, the malleability of the sound system allowed the gradual increase in English input to have an effect on the Cantonese sound system acquired by the young HSs.

There was one point of similarity between the two groups, in that there was no change in the scores over the age range tested. It might be expected that there was no change for the HK group, if phonological development was more or less complete by the youngest AOT. The lack of significant change in the HSs seems to suggest that the

children's production was already divergent from their HK group peers' by around age 5 (the youngest AOT), and that there was no further development towards the target form of Cantonese. On the other hand, on average there was no decrease in scores either, which indicates that the HSs did not become more accented. This could be because any change in the Cantonese sound system due to the shift to English happened relatively soon after the onset of English, or be related to stability in the relative amount of Cantonese/English use. Examining HSs' speech by smaller units, such as at the phonemic level, might reveal patterns that are less apparent when broad measures such as comprehensibility are used. Finally, these results do not mean that change could not occur past age 12 (the oldest AOT), merely that it was not detected within the tested age range.

There are some questions that the above findings raise, that the present data is unable to answer. For example, it is unclear why the HSs received relatively low scores for comprehensibility, given the full mutual intelligibility between HKCAN and GZCAN and the simplicity of the speech samples in terms of vocabulary and grammar. In addition, it appears that the raters perceived some differences between speakers who were 'Mandarin-dominant' (which was not the case for any participant in reality) and English-dominant speakers speaking Cantonese, but it is not known how raters decided between the two. Table 4.10 shows that based on the scores received, the speakers categorised to a Mandarin background were apparently more similar to those assigned to the United States, rather than those assigned to a GZCAN background. However,

Mandarin is in some way more similar to Cantonese than English is, for example, both Mandarin and Cantonese are syllable-timed and have lexical tones, while English is stress-timed and does not have tones. In future research, L1-Mandarin learners of Cantonese could also be tested in order to find out how such learners would compare to HSs and majority language speakers.

4.4.2 Predictors of HS performance

Figure 4.1 shows that the HSs were not all judged to be divergent in their production. The HSs had a larger range of individual scores and were not clearly assigned to any one category, which is consistent with previous research (e.g., Chang & Yao, 2016; Flores & Rato, 2016; Kupisch, Barton, et al., 2014). However, none of the tested predictors had a significant effect on speakers' scores. A potential reason for such results is that the measurements used may not have adequately reflected the actual variance in the predictors. For the purpose of quantitative analysis, the participants' linguistic background was reduced to one-dimensional scores. Also, the absence of a significant effect of exposure in this study may be due to a non-linear effect of changes in input and output on HL production (e.g., Thordardottir, 2015; Paradis & Genesee, 1996), since Cantonese was the main language used at home for all HSs and there was not a large variance within the group. The range in productive ability could also be related to differences in Cantonese use with speakers other than parents, who were not included in the analysis. Moreover, only the proportion of Cantonese use was considered and not

the absolute amount, which could have over-estimated the amount of Cantonese used by, for instance, HSs whose parents work in the evenings and do not interact much with their children. There are also factors not included in this study that could help explain the range of HS scores obtained, for example language preference (Kupisch, Barton, et al., 2014). Most of the HSs appeared to be English-dominant, as the researcher found that some were more reluctant to speak Cantonese and quicker to switch to English during the story-telling task. Preference for English could be due to low Cantonese proficiency, but could also stem from a stronger identification with the English-based culture of mainstream society or of their peers, therefore here a survey of the HSs' attitudes would be important.

The qualitative analysis showed several possibilities for further research. The actual level of reading and writing skills could be tested for a more accurate measurement of literacy than self-report. Analysis on the samples showed that the HSs produced tones and vowels noticeably differently, so additional studies at a segmental level, with a narrower scope, might yield findings that are more difficult to obtain with a broad measure. The heterogeneity of HS populations makes it difficult to identify which and how factors predict HL production, therefore more research should be dedicated to this line of investigation.

4.5 Conclusion

The findings of this study have implications for our understanding of how acquired sound systems can be altered—or how developing ones progress along a different trajectory—due to the acquisition of additional languages or changes in linguistic environment. Further research could reveal which factors predict the outcomes of HL development. It would also be important to examine HSs in other age ranges; the findings here may not be replicated even if the same group were re-tested after a period of time, as speakers' linguistic abilities continue to develop and change in the intervening years.

Accents do not necessarily hinder communication, but HSs with accents noticeably different from their family's could feel alienated, or be perceived differently by other speakers compared to how they would identify themselves. Speech of low comprehensibility can be easily misunderstood, and create frustration for the speaker who cannot effectively convey a message and might even avoid using the HL. In this study, the HSs' phonetic divergence from the target was perceivable by other speakers of the same language and its influence extended beyond the judgment of linguistic ability into that of demographic background. Therefore, the impact of phonetic divergence is not only on language use, but also on attitudes towards HSs and relationships between speakers.

Chapter 5

Production of Cantonese classifiers in young heritage speakers and majority language speakers

5.1 Introduction

HSs often differ systematically from monolinguals in their morphosyntactic abilities, and although not all morphosyntactic features pose problems for HSs (e.g., Pires & Rothman, 2009; Santos & Flores, 2016), inflectional morphology has proven to be particularly difficult (e.g., Benmamoun et al., 2013b; Montrul, 2011; Song et al., 1997). HSs have been reported to reduce and simplify morphological systems by lowering the number of distinctions and naturalising marked forms in favour of defaults (e.g., Montrul & Bowles, 2009; Polinsky, 2008a; Polinsky & Kagan, 2007). While previous

research has revealed much about the underlying linguistic knowledge of HSs, much of it targets inflectional features. The present study examines classifiers in Cantonese, which is analytic and lacks inflections.

5.1.1 Cantonese classifiers

The classifier (CL) is a morpheme involved in enumeration and quantification, and different nouns require different classifiers. Classifiers are also present in many languages spoken in South, Southeast, and East Asia. In Cantonese, a classifier is typically used before a noun (N), although bare nouns can be used when the reference is generic. Classifiers are required following numerals, demonstratives, and quantifiers (e.g. (3–5)). (In this thesis, target words that have no corresponding standardised Chinese character are denoted using the closest Chinese character with the target tone marked by the accompanying superscript number.)

(3) 兩　隻　狗
loeng5 zek3 gau2
NUM CL N
'two dogs'

(4) 個^{2}　隻　狗
go2 zek3 gau2
DEM CL N
'that dog'

(5) 每 隻 狗
mui5 zek3 gau2
Q CL N
'every dog'

By more conservative estimates, there are around 60 classifiers in Cantonese (Erbaugh, 2002; Li & Lee, 2001). Mensural classifiers classify nouns according to quantity. For example, 兜 *dau1* is used for a basinful of any liquid, and 疊 *daap6* for a pile of printed material. Since mensural classifiers are similar to collective nouns in English, they were excluded from the present study. Sortal classifiers individuate nouns according to their features, including shape, animacy, and function. Most nouns are associated with only one sortal classifier, and using a different classifier is usually unacceptable and considered erroneous. The semantic content of classifiers often reflects certain characteristics of co-occuring nouns (Allan, 1977; Killingley, 1982, 1983; Tsang & Chambers, 2011). However, some classifier-noun pairings that are opaque and unpredictable cannot be learnt via semantics or prototypicality, to the extent that some classifier-noun associations appear arbitrary (Erbaugh, 1986; Matthews & Yip, 2011). For example, 條 *tiu4* is used with long, thin objects, including snakes and trousers. 把 *baa2* is used with hand-held objects with a handle, including umbrellas and tools like scissors. However, it would be considered ungrammatical to say *一條刀 *jat1 tiu4 dou1*, even though knives are long and thin. In most cases, classifier-noun associations cannot be violated for pragmatic effect, and deviant use of classifiers is highly conventionalised and infrequent (Killingley, 1986).

The sortal classifier *go3* occurs frequently, and is considered a general or default classifier (e.g., Chao, 1968; Erbaugh, 1986; Li & Thompson, 1981; Stokes & So, 1997). 個 *go3* is associated with nouns with different characteristics, including those denoting small, roundish objects (e.g. apples, balls), human beings, and abstract entities (e.g. ideas, dreams) (Matthews & Yip, 2011). It is the first acquired classifier in children, and even after other classifiers start emerging, *go3* is still often preferred and overused past age 5-6, whereas the overuse of other classifiers (e.g. *zek3*) is infrequent (Mak, 1991; Poon, 1980; Szeto, 1998; Tse, Li, & Leung, 2007). However, unlike a truly general classifier, *go3* cannot be used with all nouns (e.g. not with animals or utensils). Adult speakers also occasionally overuse *go3*, especially in informal speech, although such use is not perceived as 'proper' (Killingley, 1986; Li & Lee, 2001). In this study, a specific classifier will refer to any sortal classifier that is not go3.

5.1.2 Monolingual acquisition of sortal classifiers

In monolinguals, systematic use of classifiers in spontaneous speech is observed from around age 2. Syntactic errors, including omission and double use (6), are rare and disappear by age 3 in normally developing children (Poon, 1980; Szeto, 1998; Tse et al., 2007).

(6) *個[2] 個 把 刀
go2 go3 baa2 dou1
DEM CL CL N
'that knife'

Initially, children use only a limited number of classifiers, such as *zek3* and *go3* (Szeto, 1998). The classifier repertoire expands rapidly after age 3, and accuracy in selecting classifiers also improves (Mak, 1991; Poon, 1980; Szeto, 1998; Tse et al., 2007). By age 6, children use at least 27 sortal classifiers productively, although selection of classifiers is not yet adult-like (Poon, 1980; Tse et al., 2007). As far as the author is aware, no study has shown when children converge on adult-like performance. Different theories have examined whether there is an order of acquiring classifiers, based on for example semantic diversity (Mak, 1991) and perceptual characteristics (Erbaugh, 1986; Tse et al., 2007). However, no definitive order has been established so far.

5.1.3 Bilingual acquisition of classifiers

Classifiers share some characteristics with other grammatical properties that HSs struggle with, including requiring the integration of information from both the syntax and semantics domains, and involving unpredictable form-meaning mapping, in this case between classifiers and nouns (Laleko & Polinsky, 2013; O'Grady, Kwak, et al., 2011). Classifiers are also a late morphosyntactic feature, and late features are often problematic for HSs since the majority language is used more and more at the expense of the HL, as HSs grow older (e.g. Montrul, 2008). In addition, classifiers and nouns do not always co-occur, which compounds the negative effects of low input: classifiers can be used without the noun (as in (7)), and some noun phrases do not require a classifier at all (e.g. for an indefinite reading). (Note that in (7), the second classifier still has to

be appropriate for the dropped noun.)

(7) 我 有 兩 隻 狗 ，而 你 有 三 隻 。
ngo5 jau5 loeng5 zek3 gau2 yi4 nei5 jau5 saam1 zek3
N V NUM CL N CONJ N V NUM CL
'I have two dogs, and you have three.'

In HSs of Cantonese, classifier repertoires tend to be small, and speakers overuse, or even use only *go3* (Chan, 2011, Li & Lee, 2001). There are syntactic errors, including omission and using double classifiers, even in HSs who are past the age where monolinguals make these errors. However, older participants show more target-like use of classifiers, indicating that development can still occur in later childhood (Chan, 2011; Li & Lee, 2001). Classifier knowledge varies between individual HSs. For example, two participants in Li & Lee (aged 5 and 9) had only limited productive ability in Cantonese and did not produce a single classifier. Some of Chan's participants made use of perceptual features to select classifiers, while others showed little awareness of the semantic nature of the classifiers. Chan also found that more frequent Cantonese use at home and positive attitudes towards one's heritage contributed towards better performance.

Based on the above findings, the current study aims to further investigate the acquisition of Cantonese classifiers by comparing HSs to majority language speakers. The first research question asks whether the two groups have similar classifier knowledge. Since the syntax structure of classifiers is acquired earlier, HSs are expected to be more target-like in their syntax than in their classifier selection. The second research

question asks what language background factors play a role in HSs' knowledge of Cantonese classifiers. Previous research found that AOA (Jia & Paradis, 2015) and language experience (Chan, 2011) mediate the performance of individual speakers. This study will seek to corroborate these findings.

5.2 Methodology

5.2.1 Participants

5.2.1.1 HSs

72 HSs were recruited from three primary schools in New York City. They were all students in an after-school programme led by Chinese staff, and an initial survey to parents confirmed that Cantonese was used predominantly at home. The participants' age ranged from 3;10–11;3 (mean = 8;7, SD = 1;8). The majority of the HSs were born in the United States (n = 44). 23 were born in China, four in Hong Kong, and one in Mexico. Among the participants born in China, all who specified a town or province were born in areas where Cantonese is commonly spoken. The age of arrival (AOA) for participants born outside the United States (with data provided by 24 of 28 participants) ranged from 0;6–9;5, with a mean of 4;5 (SD = 2;8). The HSs' parents were all native speakers of Cantonese and had high self-reported proficiency, out of 6, they scored 5.59 (SD = 0.81) and 5.63 (SD = 0.34) for listening and speaking respectively. The parents

used mainly Cantonese with their children, with an average proportion of 78.85% (SD = 27.68%) by fathers and 74.64% (SD = 31.06%) by mothers. The participants themselves also used mainly Cantonese with their parents, on average 76.92% (SD = 30.40%) of the time with their fathers and 69.57% (SD = 30.58) with their mothers.

26 HSs reported speaking or hearing languages/varieties other than Cantonese at home, including English (n = 15), Mandarin (n = 9), and Toishanese (n = 7). English was the main language used at school, with 55 HSs reporting that teachers used only English, and 47 reporting that they used only English with other students. 21 participants attended extra-curricular Chinese classes, with 10 learning in Cantonese, nine learning in Mandarin, and two learning in both. 28 reported being literate in Chinese, defined in this study as being able to read/write simple texts of more than a few words.

5.2.1.2 Hong Kong (HK) speakers

61 children in Hong Kong were tested as a control group. They were all born in Hong Kong, apart from one who was born in China and had moved to Hong Kong at the age of 5 months. Their age ranged from 5;3–12;4 (mean = 9;3, SD = 1;10), and they were overall older than the HSs (t(122.36) = 2.27, p < 0.05). Their parents were all native speakers of Cantonese. At home, Cantonese was used most the time, with parents using Cantonese on average 86.42% of the time (SD = 16.61%), and children using Cantonese 89.41% of the time (SD = 16.48%). 31 spoke or heard languages/varieties other than

Cantonese at home, including English (n = 20), Mandarin (n = 15), Teochew (n = 3), and Fujianese (n = 2).

In Hong Kong, children usually start learning English in kindergarten, and the study of English is compulsory throughout primary and secondary education. The medium of instruction for the majority of the HK participants was mostly or only in Cantonese (n = 42), and the majority used mostly or only Cantonese with other students at school (n = 57).

Written consent for testing and use of data collected was obtained from the parents of all participants before the participants completed the tasks.

5.2.2 Instruments

5.2.2.1 Picture-naming task

A picture-naming task was used to elicit responses with the NUM+CL+N structure. Six sortal classifiers were targeted for their high frequency of use in children and association with frequent nouns (Tse et al., 2007). Mensural classifiers were not tested due to their similarity with English collective nouns.

Each target classifier was elicited using three common objects, resulting in 18 different target objects (Table 5.1, p. 146). Related objects were avoided as much as possible

in order to construct a more diverse set of stimuli. There is some variation in which classifiers are acceptable with a given noun, particularly because of regional differences. The target classifiers in Table 5.1 are not always the only ones acceptable for respective target nouns. During scoring, all acceptable classifiers, as judged by three adult majority language speakers, were counted as correct.

The task was presented on an 8" screen tablet using Opensesame (Mathôt et al., 2012). In each trial, a circle and a square appeared side-by-side, each containing two, three, or four colour images of the target object. The images were from Brodeur, Dionne-Dostie, Montreuil, and Lepage (2010) and Moreno-Martínez and Montoro (2012). A list of the images used are listed in Table B.1, Appendix A.6, p. 232. Participants were instructed to describe what was in the circle. The number of objects in the circle was different from the number in the square, so as to elicit a numeral in the response (Eisenbeiss, 2009), which in turn required a classifier. Figure 5.1 (147) shows an example of a trial, where the square contained two butterflies, and the circle contained three. The target response would be 三隻蝴蝶 *saam1 zek1 wu4dip2* 'three butterflies'. Participants were instructed to tap the screen once they had completed their response, and the next trial would begin.

There were two blocks of trials, and each target object was presented once in each block. There were two pseudo-randomised lists for each block to counterbalance the order of presentation across participants. The lists ensured that the target number, the target classifier, and the position of the circle on the screen were not repeated in consecutive

Classifier	Description (Matthews & Yip, 2011)	Target object (English)	Target object (Cantonese)
個 *go3*	General and neutral classifier	Apple (Foot)ball (Paper) bag	蘋果 *ping4gwo2* 足球/波 *zuk1kau4/bo1* (紙)袋 *(zi2)doi2*
張 *zoeng2*	For flat, horizontal objects	Bed Chair Table	床 *cong4* 凳 *dang3* 檯 *toi2*
粒 *lap1*	For small objects	Peanut Strawberry Button	花生 *faa1sang1* 士多啤梨 *si6do1be1lei2* 鈕 *lau2*
隻 *zek3*	For animals and one of a pair	Hand Horse Butterfly	手 *sau2* 馬 *maa5* 蝴蝶 *wu4dip2*
條 *tiu4*	For long, thin objects and certain animals	Fish Trousers Key	魚 *jyu2* 褲 *fu3* 鑰匙 *so2si4*
把 *baa2*	For tools and instruments	Scissors Knife (Beach) umbrella	鉸剪 *gaau3zin2* 刀 *dou1* (沙灘)遮 *(saa1taan1) ze1* / (太陽)傘 *(taai3jeong4) saan3*

Table 5.1 Target classifiers and associated objects

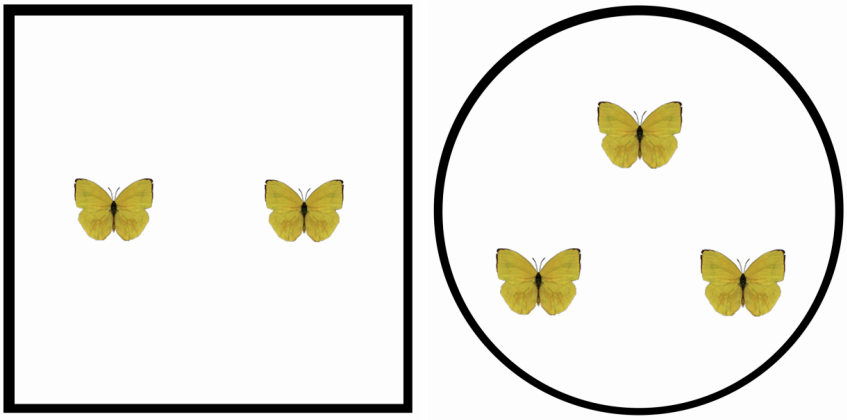

Figure 5.1 Example of a trial. The butterfly image is from Moreno-Martínez & Montoro (2012)

trials. A training task was conducted using a different set of stimuli. Responses were recorded using a desktop microphone connected to a handheld digital recorder.

5.2.2.2 Language background questionnaire (LBQ)

An LBQ for parents, written in Chinese, was used to collect data on the participants' language background. The questionnaire was adapted from the BiLingual Language Experience Calculator (BiLEC) (Unsworth, 2013), and was distributed to participants to take home after testing. The questionnaire targeted information on the participants' background, parents' background, and the participants' language use. Some questions were only applicable to HSs, such as AOA and whether or not they were literate in Chinese. A shorter, English, oral version of the questionnaire was also administered to the participants. 11 HSs did not return their questionnaire, so their own responses

were used in the analysis.

5.3 Results

5.3.1 Scoring

The participants' performance was evaluated based on two aspects of using classifiers. First, grammatical accuracy referred to whether a classifier was used in an obligatory context (i.e. when a response contained a number and a noun). Responses containing non-Cantonese nouns were excluded from the calculation. Selection accuracy referred to whether, when a classifier was used, it was appropriate for the noun. Responses containing non-target Cantonese nouns were included as long as the appropriate classifier for the actual response was the same as for the target noun. For example, the utterance 'three cows' in response to a picture of three horses was included because 'horse' and 'cow' require the same classifier (*zek3*). If a classifier was used with a non-Cantonese noun, the Cantonese equivalent was used to determine the appropriate classifier.

Multiple regression analyses were conducted to compare the grammatical and semantic accuracy of the two group of participants. Binomial generalised linear mixed models were fitted using the lme4 package (Bates et al., 2015) in R (R Core Team, 2016). Participants were entered as Subject, and the different target objects as Object, both

as random variables. The dependent variable was accuracy on each trial. Models were fitted by adding predictors one by one and retaining only significant predictors. Likelihood ratio tests and AICs were used to obtain final models with the best fit.

5.3.2 Grammatical accuracy

In terms of grammatical accuracy, the HK group performed at ceiling, with only two participants not scoring 100%. The mean score for the HSs was also near ceiling (97.07%, SD = 10.28%), but the range of scores was much larger. 41 out of 72 participants scored 100%, 30 between 63% and 97%, and one scored 31%. One HS omitted classifiers in half of his responses, but the proportion of omission was lower for other participants (at most 23%). Regression analyses revealed no significant effect of Group ($p > 0.05$), indicating no overall difference between the two groups.

Some HSs used classifiers with nouns in Mandarin or other Chinese varieties, which have similar classifier rules. Classifiers were also used with English nouns, some of which were inflected for plural (e.g. (8) by a HS). One HK participant used English in five trials, while 16 HSs used English nouns in 81 trials.

(8) *三　　個　nuts
saam1 go3 nuts
NUM CL N
'three (pea)nuts'

5.3.3 Selection accuracy

Table 5.2 shows the selection accuracy scores of the two groups and the distribution of scores. Overall the HK group performed well, with eight participants scoring 100%, and 27 scoring 91.43%–97.22%. The HSs had lower scores, with only 12 scoring above 50%.

	HS				HK			
	Mean	SD	Min	Max	Mean	SD	Min	Max
Overall	32.52	20.45	9.09	93.33	90.16	10.51	55.56	100
go3	98.92	5.6	60	100	96.17	9.33	50	100
zeong1	21.13	35.74	0	100	94.81	13.1	33.33	100
baa2	17.74	30.29	0	100	93.72	17.26	0	100
tiu4	18.5	33.24	0	100	86.01	20.91	0	100
lap1	5.12	16.19	0	83.33	75.3	28.2	0	100
zek3	19.69	29.31	0	100	94.54	9.96	66.67	100

Table 5.2 Selection accuracy scores (%)

Figure 5.2 shows that performance was not equal for the different classifiers. Almost all the HSs scored 100% for *go3* but 0% on all specific classifiers. The HSs scored the lowest (between 0–10%) on 'button', 'peanut', and 'strawberry', which all required *lap1*, while the HK participants scored lowest (< 80%) on 'strawberry' and 'peanut', which required *lap1*, and 'key', which required *tiu4*. These results suggest that knowledge of *lap1* was particularly poor, regardless of target object.

The selection accuracy of the two groups was compared using regression analysis. The HK group was on average older and there was a significant correlation between semantic accuracy and AOT in the HK group (r = 0.40, p < 0.01), but not in the HSs (p > 0.05). Therefore, age-matched subgroups were used for this analysis, with 52

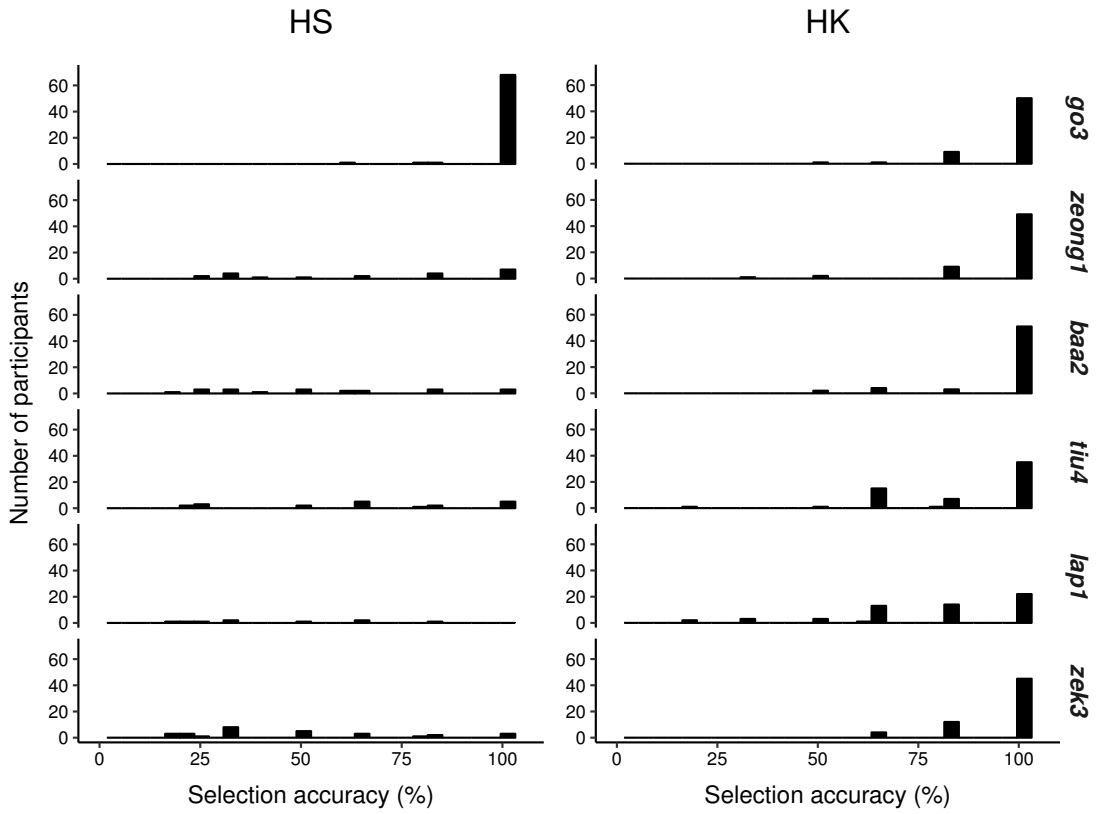

Figure 5.2 Distribution of selection accuracy scores

participants from each group. The final model is shown in Table 5.3 (condition R^2 = 0.36, marginal R^2 = 0.82), and the results showed that HSs were less accurate at selecting classifiers.

	Estimate	Std. Error	z value	p value
(Intercept)	3.98	0.64	6.21	< 0.001
Group	-5.33	0.39	-13.83	< 0.001

Table 5.3 Model for selection accuracy

5.3.4 Classifier substitution

The substitute classifiers used by each group of participant are listed in Table B.3, Appendix B.2, p. 235. Table 5.4 shows the types of substitutes used in the responses containing non-target classifiers. Both groups showed a high reliance on *go3*, while substitution using a specific classifier was infrequent. As the results in the previous section showed that most HSs could not produce any classifier other than *go3*, it appears that they were using *go3* indiscriminately regardless of which classifier was appropriate for the context.

21 HSs produced a total of 63 responses containing double classifier constructions (e.g. (9), (10)), with *go3* inserted before the target specific classifier. This construction was restricted to seven target objects, including 'knife' and 'umbrella' (requiring *baa2*), 'horse' (requiring *zek3*), 'fish' (requiring *tiu4*), and 'bed', 'chair', and desk' (requiring *zeong1*).

(9) Target: 三 張 床
saam1 zeong1 cong4
'three beds'

Response: *三 個 張 床
saam1 go3 zeong1 cong4

(10) Target: 兩 把 遮
leong5 baa2 ze1
'two umbrellas'

Response: *兩 個 把 遮
leong5 go3 baa2 ze1

Noun type	Group	Number of responses/Type of substitute					
		Total	*go3*	Specific classifier	Mensural classifier	Non-classifier words	Double classifier construction
Cantonese	HS	997	908 (91.07%)	19 (1.91%)	3 (0.30%)	6 (0.60%)	61 (6.12%)
	HK	206	171 (83.00%)	31 (15.05%)	4 (1.94%)		
Non-Cantonese Chinese	HS	32	30 (93.75%)	2 (6.25%)			
English	HS	6	5 (83.33%)	1 (16.67%)			
	HK	71	71 (100%)				

Table 5.4 Number of responses containing different patterns of substitution

In a minority of cases, a specific classifier was used as a substitute for the target classifier. In 18 of the HK participants' responses and seven of the HSs', the substitutions can be viewed as extensions of the semantic scope of the chosen classifier. In (11), the HS used *zek3* for the target object 'fish'. Since *zek3* is used for animate objects (albeit usually four-legged animals), the participant's choice of classifier matched an important characteristic of the target object. Other substitutions were less logical semantically. For example, *zi2* and *zek3* in (12) and (13) (both by HSs) usually refer to long, thin objects and animate objects respectively, which are not congruent with the target objects.

(11) Target: 四 條 魚
sei3 tiu4 jyu2
'four fish'

Response: *四 隻 魚
sei3 zek3 jyu2

(12) Target: 三 個 蘋果
saam1 go3 ping4gwo2
'three apples'

Response: *三 支 蘋果
saam1 zi1 ping4gwo2

(13) Target: 四 張 床
sei3 zeong1 cong4
'four beds'

Response: *四 隻 床
sei3 zek3 cong4

19 HK participants also used 把 *baa2* with 'key', which is a pairing used in Mandarin. Since Mandarin is taught in schools in Hong Kong, the HK participants may have transferred this classifier-noun pairing from Mandarin to Cantonese.

5.3.5 Predictors of HSs' selection accuracy

Multiple regression analyses were used to investigate which language background factors predicted selection accuracy among the HSs. Trials targeting *go3* were excluded from this analysis as scores for *go3* were at ceiling. The following predictors were considered:

- AOT
- Cantonese experience (obtained by taking the mean of four measurements from the LBQ: the proportion of Cantonese used by the participant with each parent, and vice versa, α = 0.90)
- Chinese literacy

The final model (Table 5.5) shows that the HSs who used more Cantonese with their parents were more accurate at selecting classifiers, while AOT and Chinese literacy had no predictive effects on scores. The overall model fit was conditional R^2 = 0.20, marginal R^2 = 0.76.

	Estimate	Std. Error	z value	p value
(Intercept)	-1.57	1.19	-1.32	0.19
Cantonese experience	-2.97	1.44	-2.06	< 0.05

Table 5.5 Model predicting selection accuracy for HSs

Considering only the HSs born outside the United States, further analyses on AOA and AOT (Table 5.6) showed a significant effect of AOA only (p < 0.05), indicating that later arrivals selected classifiers more accurately independent of their AOT.

	Estimate	Std. Error	z value	p value
(Intercept)	-3.62	2.48	-1.46	0.14
AOA	0.78	0.26	3.00	< 0.01
AOT	-0.34	0.34	-1.00	0.32

Table 5.6 Results of multiple regression on AOA and AOT

While AOT did not have a predictive effect on selection accuracy, Figure 5.3 shows that the HSs progressed towards higher accuracy after age 10. In this figure, individual participants' scores for each target classifier were plotted against AOT, and a loess curve was fitted for each classifier with a span setting of $\alpha = 0.70$. In comparison, there was less change in the HK participants' scores after around age 8. Individual differences can be observed for both groups of participants, with many participants' scores deviating from the group trend.

5.4 Discussion

Classifiers are used in fixed grammatical environments, and the form of classifier required can be related to perceptual characteristics of the following noun, but is sometimes unpredictable solely from semantics. This study compared young HSs of Cantonese to peers from Hong Kong, and found that the two groups were similarly accurate in producing a classifier where required. Even though the HSs were acquiring Cantonese in a minority language context, as a group they were similar to the majority language speakers in this aspect.

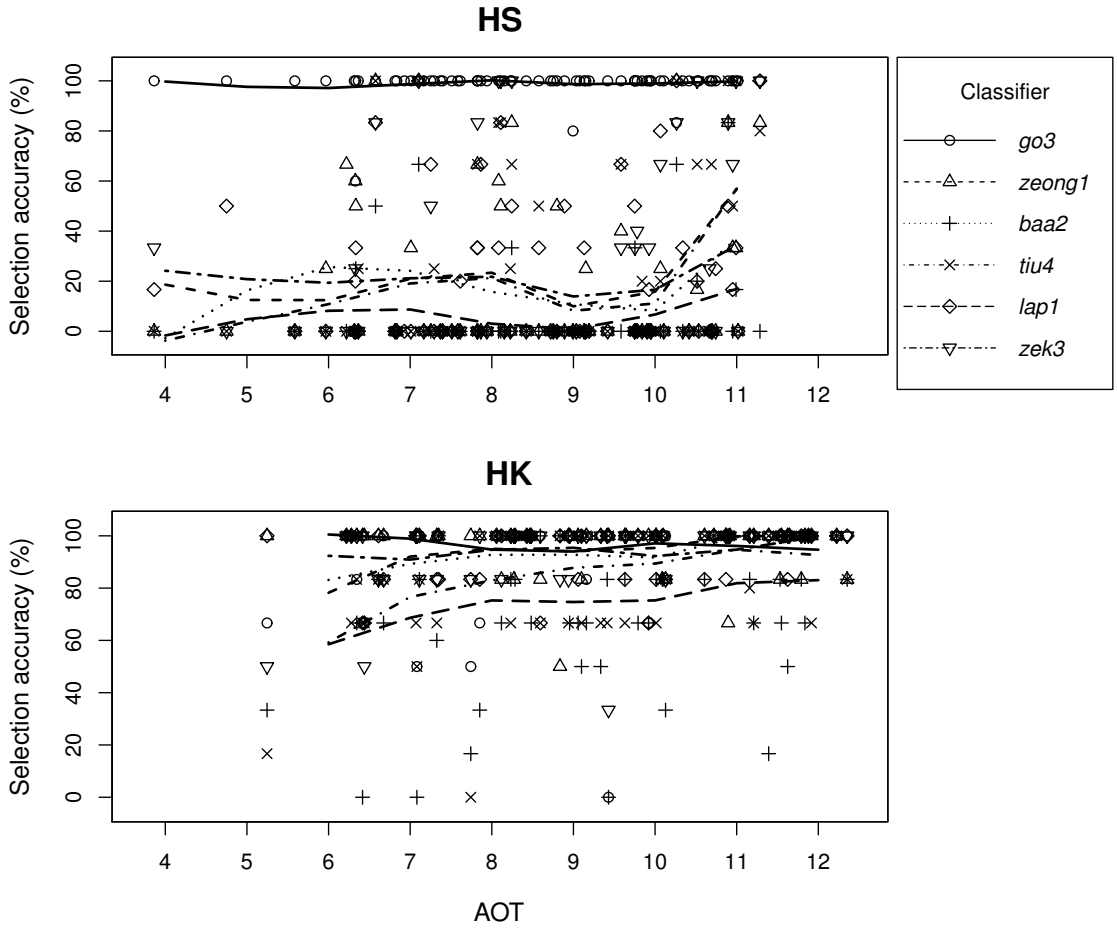

Figure 5.3 Selection accuracy scores for different classifiers across the AOT range

Individually, there was a wide range of performance, with one HS scoring as low as 31%. Omissions can be performance errors, but could also be due to poorer productive ability, for example if a speaker seeks only to name the essential, meaning-bearing elements of the numeral and the noun. Previous research found that omission occurred only in monolinguals younger than age 5 (Poon, 1980; Szeto, 1998), or age 8 for HSs (Li & Lee, 2001). In the current study however, HSs up to age 11;1 omitted classifiers, suggesting that HSs' use of classifiers is not guaranteed even in later childhood.

The use of double classifiers reflects the opposite problem of omission. Double classifiers were used mostly with utility items or furniture, such as 'knife', 'bed', and 'chair'. Since these objects are used in daily life in the generic sense or with definite reference (14), where no numeral is used, the HSs may have heard classifiers used without a numeral so frequently that they interpreted the classifier and noun to form a single noun, and added *go3* as the classifier during production (Matthews & Yip, 2011; Poon, 1980).

(14) 俾 把 刀 我
bei2 baa2 dou1 ngo5
V CL N $_{\text{D.OBJ}}$ $\text{N}_{\text{IND.OBJ}}$
'give me a knife'

14 of the 22 HSs who used double classifiers used only *go3* otherwise, which is indicative of an inability to use specific classifiers productively. Furthermore, follow-up conversations with the participants who used double classifiers revealed that most of them considered the specific classifier to form part of the noun representing the relevant objects. As such, the one-noun phrase interpretation is applicable to the present data.

In terms of classifier selection, while the HK participants selected classifiers with high accuracy, most HSs were only able to produce *go3*, and used specific classifiers only infrequently or not at all, even though the specific classifiers included in the current study were all common ones. Some of the HSs may have obtained high scores on trials targeting *go3* just because *go3* happened to be the one form acquired, i.e. *go3* might not be just the default, but in fact the only form of classifier acquired. The reduction

in the number of different forms being used, in some cases to only the default, is not unlike that observed in HSs for other morphosyntactic systems (e.g., Polinsky, 2008b). Some HSs also used mensural classifiers, showing a type of cross-category substitution that has not been observed in the HK participants in this study or in monolinguals in previous research (Tse et al., 2007).

Within the age range tested, there was no indication that classifier knowledge became lost or inaccessible with the dominance of English. Figure 5.3 shows that between ages 4-10, the knowledge that was already required remained unchanged, possibly since there was no directly competing system in English. After age 10, sufficient input might have been accumulated from various sources, including family members and Chinese classes, for development to 'resume'. Therefore, although AOT had no predictive effect on the HSs' selection accuracy, the HSs may eventually become more like their HK group peers at a later age.

5.4.1 Input

In this study, the HSs were similar to the HK group only in using (any) classifiers where required, but not in selection. Since the grammar develops earlier, it may have been acquired by the time the HSs attended school, whereas the classifier repertoire was still expanding and was therefore affected by the shift towards English. Faced with reduced input, HSs often develop more slowly, leading to non-target-like acquisition

(e.g., Rinke & Flores, 2014; Unsworth, 2013). Even though the HSs in this study used mainly Cantonese at home, just like the HK speakers, there were other sources of input differences, the most obvious one being the society, as the dominance of English in the United States meant that the HSs received less Cantonese input.

Reduced input has a strong effect on the development of classifiers, because the form of classifier is not always predictable from the perceptual features of the following noun and large amounts of input are required to form classifier-noun pairings. The HSs might also have received input that was qualitatively divergent from the homeland variety, if attrition had occurred in the Cantonese of their parents or other first generation immigrants (Sorace, 2004). The HSs' parents' classifier knowledge was not investigated in the current study, but Lo & Nagy, 2016, using conversational data from the Heritage Language Variation and Change in Toronto Corpus (Nagy, 2011), reported no simplification pattern in first and second generation immigration speakers compared to homeland speakers. However, a simple analysis of 10 speakers' data in this corpus (five from each generation) revealed that the majority of instances where a classifier was required called for only the default *go3* or the plural *di1*, so the results are not directly applicable.

The effects of input can also be observed at a within-group level, as the HSs who had more Cantonese exposure, whether through use with their parents or by virtue of arriving later in the United States, selected classifiers more accurately. Concerning AOA, the pre-immigration period of living in a majority language environment offers

maximal Cantonese input or even schooling in Cantonese, leading to advantages in acquiring a frequency-dependent grammatical structure. These results are consistent with previous findings that show the benefit of more input and later AOA for target-like acquisition of HLs (e.g., Gathercole & Thomas, 2009; Jia & Paradis, 2015; Montrul, 2008; Unsworth, 2013).

5.4.2 Cross-linguistic influence

The lack of sortal classifiers in English did not appear to lead to loss in Cantonese. Perhaps collective nouns in English, which are similar to mensural classifiers in Cantonese, even ensured the maintenance of classifiers. However, there was an unexpected case of cross-linguistic influence, where the participants applied a typically Mandarin classifier-noun pairing to Cantonese. Many schools in Hong Kong have recently started teaching Chinese in Mandarin as opposed to in Cantonese. Therefore, it is possible that young speakers in Hong Kong gained proficiency in Mandarin and transferred this choice of classifier. In contrast, an informal survey of adult speakers in Hong Kong revealed that they were less inclined to accept the use of *baa2* with 'key', speakers older than 40 years categorically rejected it, and younger adults preferred tiu4 but accepted *baa2* in writing. This suggests cross-generational differences due to increased influence from Mandarin, but it is also possible that the HK participants had merely confused 鎖 *so2* 'lock' (which requires *baa2*) and 鑰匙 *so2si4* 'key'.

5.5 Conclusion

If the semantic content of specific classifiers is viewed as a reflection of the characteristics of associated nouns (and so somewhat redundant), then the default classifier can be used in place of specific classifiers without compromising the overall conveyed meaning, and perhaps even reduce the cognitive burden of processing. Such a possibility is particularly important for HSs, who might not all receive adequate input to learn unpredictable classifier-noun pairings. While the data so far indicates that the HSs diverge from majority language speakers in terms of classifier repertoire, their ability to use classifiers where required reflects a degree of mastery of Cantonese, which would enable them to communicate with other speakers. In addition, further development at a later age should not be precluded, especially in speakers who pursue studies in the HL or who move to the homeland.

The present study was limited to the production of six sortal classifiers, so further research could investigate comprehension or mensural classifiers. However, investigating classifiers or even Cantonese as an HL is not straightforward: HSs grow up among linguistically diverse speakers using different Chinese dialects and varieties, all of which are sufficiently dissimilar, that it is not easy to attribute certain patterns of language use to for example dialectal variation, divergent development, or cross-linguistic transfer.

Chapter 6

Discussion

6.1 The linguistic performance of the HSs

This thesis aimed to find out how Cantonese developed in HSs living in New York City, and what factors predicted their abilities. The HSs were compared to majority language speakers in Hong Kong in terms of Cantonese tone discrimination in Chapter 3, native-likeness and comprehensibility in Cantonese production in Chapter 4, and classifier production in Chapter 5. All three studies found differences between the two groups, the HSs were less accurate in discriminating between two pairs of tones (Tones 2 versus 5 and Tones 1 versus 4), and also between control pairs of stimuli contrasting segmentally. Their production was judged as less native-like and less comprehensible, and qualitative analysis also revealed some instances of non-target-like production.

The HSs produced classifiers as reliably as the HK participants, but their selection of the appropriate form was much poorer and most of them relied on only one default form.

These results—HSs' lower accuracy in the use of HL and divergence from target use—are consistent with previous research, not just for HSs of Cantonese but also for HSs in general. For example, HSs have been found to speak with foreign accents (e.g., Flores & Rato, 2016; Kupisch, Barton, et al., 2014), findings that have been supported by the non-monolingual-like production of segments (e.g., Godson, 2004; Leung & Goad, in prep.). Even though HSs do produce some segments like monolinguals (e.g., Au et al., 2002), it would only take divergence in some phonetic features to give the impression of a foreign accent. At the segmental level, consonants and vowels have received more attention, but Chapter 3 showed that HSs' perception of tones is also acquired divergently. Chapter 4 has additionally offered some insights into the comprehensibility of HSs' production, and demonstrated that differences between varieties can affect listeners' perception of HSs' speech and their background. Demographic classification by raters has not been widely used to study HL production so far (see for example Chang & Yao, 2016), but Chapter 4 showed that adult listeners did perceive differences between HSs and HK children after listening to a short speech sample, which can have implications on identity and relationships in addition to communication. In morphosyntax, HSs often produce inaccurate forms and even omit morphosyntactic features (e.g., Albirini et al., 2011, Kim et al., 2010). The results of Chapter 5 extend such findings to the

non-inflectional feature of Cantonese classifiers. Similar previous studies (Chan, 2011; Li & Lee, 2001) did not include peer control groups, and Chapter 5 showed that the HSs differed from their peers already in childhood.

Overall, despite early and continued exposure to Cantonese, the HSs' knowledge of Cantonese differed significantly from that of peers from Hong Kong. The HK participants served as a control group, but their inclusion in this thesis also led to some new observations that have not been made in previous studies of children from Hong Kong. For example, Chapter 3 showed that the HK children aged 5;3–11;3 were significantly less accurate in discriminating similar tones compared to more distinctive tones, and that accuracy improved with AOT. These results suggest that phonological acquisition is not complete even after age 6, at least when the tonal feature is tested in isolation. Another example concerns the selection of classifiers, as the HK children showed some transfer from Mandarin and over-extension of specific classifiers that are marked forms (Chapter 5). Therefore, this thesis, while focussed on HSs, has also contributed to research on majority language speakers of Cantonese. Incidentally, these speakers are the closest population to monolingual Cantonese speakers that can be found: children in Hong Kong and mainland China are taught Mandarin and the English language mandatorily and therefore any speaker of Cantonese is unlikely to be strictly monolingual.

The three studies in Chapters 3–5 each focussed on a different aspect of Cantonese, but participants' performance in each aspect cannot be compared directly: the tasks were

all of different natures, with two productive tasks and one receptive task, two resulting in accuracy scores and one in rater judgment, and one working at a global level and two in more detail. Neither the scope nor the size of the studies in themselves allow for a conclusion as to whether morphosyntax or phonetics/phonology is more vulnerable in heritage language acquisition. However, the target aspect of the three studies might for example be compared in terms of functional load, where features carrying higher function loads are more likely to be acquired in a target-like manner. Compared with global accent, comprehensibility, and classifier production, tone discrimination is perhaps the most important for communication purposes. When a listener hears a word, he attempts to match the perceived phonological form to the target lexical item, and perception of the tone enables the elimination of other words sharing the same syllable but produced with a different tone. Even though other cues aid word identification, a HS who cannot discriminate between tones needs to consider a larger number of words/meanings potentially matching the perceived word, and thereby faces a greater chance of misidentification and eventual misunderstanding of the speaker's meaning (Section 3.5, p. 90).

Native-likeness and comprehensibility (i.e. the quality of production) also carry a high functional load, but impact HSs when they are the speakers. In a conversation, the speaker's goal is to convey meaning in a way that the listener can understand (i.e. in a comprehensible way), and while accented speech can to an extent still be comprehended successfully (Munro & Derwing, 1999), comprehensibility is aided by/related to a native-

like manner of production (Section 4.1.1, p. 101). (Non-)native-likeness is also an external marker of (non-)membership in a particular ethnic/regional community, which adds to its importance for HSs, although on a non-linguistic level.

In contrast, classifiers might be considered less crucial for the purposes of communication. In terms of morphosyntax, classifiers have an individualising function and occur in predictable syntactic contexts, but do not function as noun markers, therefore classifiers do not have a high functional load syntactically. Nevertheless, HSs across the AOT range produced them reliably when required. In terms of semantics, the semantic meaning conveyed by different classifier forms is somewhat redundant and in fact unreliable. The results showed the semantic function to be seemingly discarded, as the HSs used mostly just one default form. Therefore, the HSs' performance can be interpreted according to functional load on a semantic level but not in terms of morphosyntactic function.

This brief discussion suggests that functional load does not fully account for whether a feature is acquired in a target-like manner or not. For example, one might expect the unpredictable classifier to have been simplified or dropped altogether, but the frequent occurrence of classifiers might have ensured its acquisition in young HSs, whereas despite the high functional load of tones, their acquisition may still have been affected by the construction of English sound categories, thus leading to inaccurate tone discrimination.

6.2 The development of Cantonese in HSs and majority language speakers

Apart from comparing the two groups of speakers, this thesis also examined their development across the tested age range. Many studies on HSs have targeted adult speakers, but studying children offers a view into how adult HSs arrive at their level of proficiency, and into bilingual development more generally. Processes such as attrition and delayed development during childhood can lead to early divergences from monolingual peers (Montrul, 2008, 2010; Polinsky, 2005, 2006), which can in turn explain divergences found in adult HSs.

Chapter 3 showed that AOT predicted the accuracy of tone discrimination for both groups of participants. One explanation for these results is that even ('near'-)monolinguals do not have a fully-developed tonal system until later childhood (at around age 9–10). The pattern shown by the HSs may be described as 'delayed development': since they were showing development just like the HK group, but were less accurate overall. In contrast, the HSs' phonological production appeared to remain stable across the age range, with no change over the years in both their accent ratings and their comprehensibility scores (Section 4.3, p. 118). That is to say, the HSs neither became more native-like, nor did they become more accented. This might be seen as a case of maintenance, where the acquisition conditions are poor enough such that there is no further development towards the target, but there is no loss of what has been acquired either. Given, both native-likeness and comprehensibility are global measures, and

other factors such as fluency and vocabulary could have equally affected the scores, so any change in only phonology specifically might have been masked in the ratings.

As for classifiers (Chapter 5), most HSs scored 100% on grammatical accuracy (i.e. using a classifier where required) (Section 5.3.2, p. 149), and this high accuracy was maintained throughout the years. Selection is a 'late' feature in comparison, that even the HK speakers were still acquiring up until about age 8 (Figure 5.3, p. 157). On the other hand, many of the HSs were unable to produce any of the target specific classifiers. There was no significant change in HSs' selection accuracy over the age range, but Figure 5.3 indicates some improvement after age 10. This suggests that the HSs might start acquiring specific classifiers after age 10, therefore demonstrating again acquisition that is delayed compared to the control group.

In sum, there was some development observed in the HSs' Cantonese, and there was no attrition. It is a positive finding that acquisition is possible even in less than ideal conditions, where the HSs heard and used less Cantonese, and instead relied more on English. Switching to English did not preclude further development in Cantonese, and the HSs could continue progressing towards more target-like Cantonese use, even if ultimately they do not converge on the performance of adult majority language speakers.

6.3 HSs compared to majority language speakers

Since both groups of participants were Cantonese-English bilinguals, the HSs were presumed to be similar to the children from Hong Kong in their early development. If the HSs had been born the homeland where Cantonese was the majority language, they would have developed just like the control group, until the point of immigration. If they had been born in the United States, they may still have lived in an effectively Cantonese-only environment while they were still young and interacted mostly with family members. The two groups also had a certain similarity in terms of English exposure, as both groups of children would have started learning English at a relatively young age, the latest by the start of formal schooling. Both groups had access to two sets of vocabulary, two potentially competing sets of grammar, and two interacting phonological systems. The importance of these early similarities is that early features can be hypothesised to be acquired in the same way in both groups, and become common points between the two groups even after the children grow older and their linguistic environments diverge. However, the studies presented in Chapters 3–5 showed that there were more differences than similarities between the two groups. Factors contributing to the HSs' divergence from the HK group's performance are discussed below.

6.3.1 Input and output quantity

Sufficient use and exposure is necessary for a language to be acquired and become stabilised. Delays are common in young early bilinguals, and result from the reduced input and output for each language since a bilingual's total linguistic experience has to be split between two languages. Even though there were no differences between the two groups of participants in terms of the proportion of Cantonese in the input from parents, the HSs used less Cantonese when speaking to their parents compared to the HK group. There were also other sources of differences, including family members other than parents, medium of instruction, peers, and media access (see Section 2.1.1, p. 59). In terms of language use in society, the HSs lived in areas with substantial Cantonese-speaking populations, and might use Cantonese with their neighbours or in their local communities. However, English was the most frequently language used around them, as it is spoken by the general American public and in schools. On the other hand, the HK group primarily used Cantonese in their daily lives, although they were also exposed to English at a young age through school or their parents.

A low amount of target language input and use often leads to non-target-like acquisition, a result that applies to HLs (e.g., Montrul, 2008; Pires & Rothman, 2009) and also to majority languages acquired by bilinguals (Law, 2006). Input and output can be calculated as the respective cumulative quantities covering the period from birth up to the present (Unsworth, 2013), but the relative proportion of a HSs' two languages at the time of testing can also be important, as recent changes in linguistic environment can

alter how acquired systems are used (Chang, 2012; Sancier & Fowler, 1997). The HSs' performance suggests that using an HL at home and hearing it from other HSs in the local community (and for some, attending language classes) do not provide sufficient input and opportunity for use for target-like acquisition of Cantonese in all its aspects.

6.3.2 Quality of input

The quality of the input available to the two groups of participants was not the same. In Hong Kong, Cantonese is used in diverse contexts. Children gain world knowledge, socialise, and go through their daily lives using Cantonese, and therefore acquire a wide range of vocabulary and expressions and are able to use Cantonese for many different purposes. In contrast, HSs tend to hear Cantonese only in the context of household or family activities and only from a limited number of speakers, and therefore can only use Cantonese in a limited range of situations. Input quality can also be affected by attrition in parents or other adult speakers (Sorace, 2004). These speakers, presumably originally similar to parents in Hong Kong, can go through language change after immigration to the United States due to reduced Cantonese use or exposure to other languages and dialects. While this thesis did not test parents' performance in the target features, previous research has shown that phonetic and grammatical attrition do occur in adult Cantonese-speaking immigrants (Chang et al., 2011; Lo & Nagy, 2016; Tse, 2016). Parents may therefore produce Cantonese in a manner that is qualitatively different to how it is spoken in the homeland, therefore providing a different target for the HSs'

(their children's) acquisition compared to the target that HK participants have.

A further aspect of input quality concerns regional variation as exposure to different varieties of Cantonese or other Yue dialects may contribute to differences between the two groups of participants. Regional variation was not relevant to the same extent for all three studies in this thesis. For example, the fact that speakers from a GZCAN background may use an additional high falling tone was not expected to affect discrimination performance in Chapter 3 (since it was not tested), but the results of Chapter 4 demonstrated that regional differences creates bias in accent ratings. More HSs than HK participants had parents from a GZCAN background, whereas HK participants are exposed mainly to HKCAN. Being exposed to contrasting varieties of Cantonese means that the target of acquisition is not the same, which can explain some of the differences between the two groups.

6.3.3 Cross-linguistic influence

Bilingual speakers do not acquire and use their two languages in isolation (Paradis & Genesee, 1996), and the development of one language can be influenced by that of the other. Non-target-like acquisition of HLs has been attributed to transfer from the majority language (e.g., Godson, 2004). For phonetics/phonology (Chapters 3 and 4), the SLM (Flege, 1995, 1999) predicts that the acquisition of English phonological categories can stimulate changes in those of Cantonese. For morphosyntax (Chapter

5), a competing (conflicting) system—the lack of sortal classifiers—could be transposed from English to Cantonese. Since both the HSs and the control group in this thesis were Cantonese-English bilingual speakers, the Cantonese of both groups could show transfer from English. However, since the HSs use English more regularly and live in an English-speaking society, they might express stronger cross-linguistic influence from English—especially if they are less proficient in Cantonese due to other reasons—and therefore become even more divergent from the HK group.

In this thesis, no clear influence from English was observed for either group. One reason possible reason is that the partial overlap between the Cantonese and English made it difficult to determine whether transfer had occurred. For example, while English does not have sortal classifiers, it does have mensural classifiers, which, like Cantonese sortal classifiers, occur between a numeral and a noun, and take different forms when used with different nouns. Another reason is that the tasks were not designed specifically to identify English influence. For example, for phonetics and phonology, the results of the demographic classification and the qualitative analysis in Chapter 4 suggest that the HSs speak Cantonese with an 'English' accent, but the accent and comprehensibility ratings did not show whether they became less native-like in the direction of being more 'English-like' in their Cantonese production. Phonetic analysis (e.g., Rao, 2015) would be needed to identify whether phonetic production of the HL takes on qualities of the majority language, and in general if a feature can be measured on a scale (e.g. VOT in terms of msec), then HSs' performance could be measured against monolingual

or bilingual norms.

Similarly, the discrimination task used in Chapter 3 does not allow the poor ability of the HSs to discriminate tones to be attributed to the lack of tones in English,if a feature of the HL does not have an equivalent in the majority language, its absence from the HSs' abilities could be motivated by simplification and not just transfer (e.g. inflection dropping). In contrast, cross-linguistic influence can be more readily deduced when the linguistic form or rule that a speaker uses can be categorically described as belonging to one language but not the other (e.g. when inflections for grammatical gender from one language is used in a second language that does not inflect for gender).

There was one clearer case of transfer, however, where some HK participants applied a Mandarin-like selection of the classifier form to use with *so2si4* 'key'. As more and more schools in Hong Kong teach Mandarin or teach Chinese in Mandarin, children become more proficient and use Mandarin more often, thus opening the door to transfer. It was also suggested that there was some evidence of cross-generational differences (Section 5.4.2, p. 161). If changes to Cantonese persist across generations, they might be considered to have been incorporated into Cantonese, and hence language change would have taken place. Cantonese is largely spoken and does not have a standardised written form, and as such is more variable and open to constant change, but to find out whether cross-linguistic influence results in lasting language change in this case would require further research.

6.3.4 Individual differences

Previous studies have investigated the heterogeneity of HSs (e.g., Flores & Rato, 2016; Jia & Paradis, 2015). The HSs in this thesis came from relatively similar backgrounds—they lived in the same borough, attended the same type of local school, and had parents with similar educational levels and types of occupation—but still, large variability was observed in each of Chapters 3–5. Mixed-effects regression analyses were used to find out whether any background variables predicted the HSs' performance. The tested variables were selected based on previous research and the available data: Cantonese experience, literacy, AOA, and gender. (AOT was also tested but more in relation to the theme of language development, and has already been discussed above.)

Cantonese experience refers to input and output quantity, and a score was calculated for each participant using the mean of the participant's proportion of Cantonese use with the father and the mother respectively, and vice versa. More input and output have been linked to more target-like morphosyntax and phonology (e.g. morphosyntax: Bohman et al., 2010; Unsworth, 2013, 2016, phonology: Oh et al., 2003; Rao, 2015; Saadah, 2011; Stoehr et al., 2017). Literacy is also indirectly related to input, and concerns both quantity and quality: while Cantonese is not written, it is grammatically and lexically similar in many ways to the standard written form used by Cantonese speakers. Therefore, HSs literate in Chinese could access a larger variety of vocabulary and grammatical structures through written material, which could then be used in their (spoken) Cantonese. HSs who acquire Chinese literacy through classroom experience

would also benefit from this additional source of exposure. Literacy was defined in this thesis as being able to read and write more than just a few words in Chinese, and no distinction was made between whether a HS had acquired literacy through Cantonese or Mandarin (or both).

As for AOA, HSs arriving later in the host country have been found to be more target-like in their production (e.g., Godson, 2004; Oh et al., 2003), as they spend a longer period of time in a HL-dominant environment and develop further in the HL before being exposed to the majority language (Allen, 2007; Montrul, 2008; Polinsky, 2004). Chapter 3 additionally considered whether there were differences between the HSs born in the United States and those born in Hong Kong/China. Finally, gender was tested to compare male and female participants. Table 6.1 summarises the results of the analyses.

Predictor	Significant?			
	Tone discrimination	Native-likeness	Compre-hensibility	Classifier selection
Cantonese experience	no	no	no	yes
Literacy	no	no	no	no
AOA	no	no	no	yes, independent of AOT
Place of birth	no	-	-	-
AOT	yes	no	no	no
Gender	no	no	no	-

Table 6.1 Whether background variables were significant predictors of performance

Predictive effects were found only for AOA and Cantonese experience for classifier

selection. Task accuracy (indicated by scores for Control category trials) also had a predictive effect on tone discrimination (Section 3.3.2, p. 88). It has been argued in previous research and in the present thesis that the acquisition of specific classifiers is particularly reliant on frequent input because of the unreliable noun-classifier pairings (Laleko & Polinsky, 2013; O'Grady, Kwak, et al., 2011), and this argument is supported by the results of Chapter 5: the HSs who with more exposure to Cantonese, whether because they had lived in the homeland for longer or because they were using proportionally more Cantonese in general, heard more exemplars of the specific classifiers so as to form appropriate pairings and produce the specific classifiers accurately.

In contrast, exposure and experience with Cantonese seemed to make little difference to the HSs' Cantonese acquisition in this thesis for phonology. Phonology might be more sensitive to recent changes in speakers' linguistic environments, and therefore less predictable by 'long-term' measurements, so that effects for input and AOA were not found in Chapters 3 and 4. The expected between-group differences in terms of Cantonese experience were not consistently found either, which suggests that the measurement of input and use might not be sensitive and detailed enough. For example, only Cantonese use between the participants and their parents was considered, and not use with other Cantonese speakers. However, even though gathering more in-depth data, for example by administering the original BiLEC to parents face to face, is generally desirable, paper questionnaires were used for this thesis due to constraints concerning time and access to parents. Sampling from a different population of Cantonese HSs—for

example in a country where there are fewer Cantonese speakers—or even including speakers from a number of different host countries might create a more heterogeneous group, so that differences among the HSs may become more obvious.

Concerning the baseline, ideally the control group would differ from the HSs only in terms of where they had been living, and the two groups would otherwise be as similar as possible. In this thesis, the effects of regional variety on the differences between the two groups were not completely controlled for. The HSs were likely to be exposed more to GZCAN or a similar variety, while the control group spoke HKCAN. This limitation reflects a general difficulty in Cantonese research, since it is difficult to account for linguistic differences between participants who do not speak the same exact variety, even if these differences may be relatively minor. Theoretically, the possible confound of regional differences could have been avoided by recruiting Cantonese-speaking children in GZCAN-speaking areas as the control, or including only HSs with a HKCAN background in the HS group. In both cases however, Mandarin remains a potential source of difference, as the HSs would likely have much lower, if any, Mandarin proficiency, while the control group would have either learnt it as the national language (in the case of children in China), or in the classroom from a young age (in the case of children in Hong Kong). Given the variation that already exists among HSs in terms of the Chinese varieties and other languages that they are exposed to, establishing even more comparable groups might require in depth assessment of participants' linguistic environments—even before testing begins—that is perhaps more

achievable on the scale of case studies.

6.4 Implications

6.4.1 Linguistic and academic performance

The Cantonese abilities of the HSs in this thesis were shown to be unlike those of their peers in Hong Kong. Non-target-like use of key linguistic features (e.g. tones) and non-native accents can hinder communication, especially if other speakers are not familiar with the divergent production of the HSs. However, the results of the studies do not portray an entirely dire future for Cantonese in New York City: the HSs showed some mastery of less crucial features (e.g. specific classifiers), and the large number of children in the three public schools, where English is the medium of instruction and there is no particular provision in terms of Chinese language education, who were able to complete most of the tasks and willing to use Cantonese with a stranger (the researcher) suggests that linguistic ability in the HL is being passed on to the current generation of children.

English is much more relevant to the HSs' academic achievement than Cantonese is, so while this thesis has only considered the HSs' Cantonese abilities, it might also be asked whether they are disadvantaged compared to English-speaking monolingual children. For example, research in the UK has shown that bilingual children speaking a minority

language at home (a.k.a. 'children with English as an additional language') tend to be academically outperformed in the earlier school years by peers who do not have English as an additional language (NALDIC, 2015; Strand, Malmberg, & Hall, 2015). If HSs mainly use the HL at home, they will not have been exposed to as much English (or any other majority language) compared to monolingual peers, and therefore may be at a lower proficiency level. Some suggestions have been made to bring the HL into the classroom in order to support these HSs' learning in school (Palmer, Martínez, Mateus, & Henderson, 2014; Taylor, Bernhard, Garg, & Cummins, 2008). However, these methods are effective only if the HSs are more able to express themselves in the HL or more proficient in it. For example, allowing the use of HL vocabulary while drafting an English composition will aid a HS only if they are literate in the HL and have a large enough HL vocabulary to draw from.

For the HSs in this thesis, the data suggests that even if the HS participants were less proficient in their English compared to English-monolingual peers, they might not benefit particularly from using more of their HL in the classroom, as their knowledge of Cantonese was limited. Fortunately, a recent study has found that Asian students in New York City public schools overcome a small, initial disadvantage to outscore white students in English Language Arts (ELA) by Eighth Grade (New York City Independent Budget Office, 2017), despite more of the Asian students being on free or reduced-price school meals (as there is also an achievement gap between the rich and the poor, e.g., Reardon, 2001). Therefore, HSs in general do not appear to be disadvantaged by their

bilingual background, in New York City at least. Nonetheless, bringing some elements of the heritage culture and language into the classroom could enrich students' learning experience.

6.4.2 In relation to other Cantonese speakers

At a social level, the HSs' non-target-like acquisition of Cantonese can affect their self-identity and relationships with other Cantonese speakers. The results of Chapter 4 showed directly that adult Cantonese speakers do perceive a difference between the speech of the HSs and majority language peers, and that they find it more difficult to understand the HSs. The HSs might be self-conscious due to difficulties in communicating using Cantonese, or at least feel different to more proficient speakers and perhaps an outsider to the Cantonese-speaking community. This could make them feel even less inclined to use Cantonese, thus creating a vicious cycle. However, the HSs in this thesis were living in a neighbourhood with many other Chinese residents and had other Chinese students in their classes, so that their Chinese culture might not be as shunned or perceived as outlandish as if they had been more isolated culturally or ethnically. Some HSs might hold a positive attitude towards their own background and be proud of their unique combination of language and cultural heritage. In North America at least, there is enough interest that some universities such as Stanford University and the University of British Columbia offer courses specifically for HSs of Cantonese.

Concerning relationships within the family, HSs could feel distanced from their parents as a result of speaking Cantonese unlike how their parents speak it, for example if they have different accents. As this thesis has shown, target-like acquisition is not guaranteed even when parents use mainly Cantonese with their children from birth, therefore parents might feel that their child was rejecting them personally, or that they were the reason their child did not speak Cantonese in a target-like manner. The LBQ data indicated that HSs used predominantly Cantonese with their parents but more English with their siblings, which could make parents (especially those with lower English proficiency) feel excluded from their children's interaction. On the other hand, some parents do deliberately encourage their child to use English as much English as possible at the expense of Cantonese, as a way of achieving social mobility and academic success in the English-speaking mainstream society (Goyette & Xie, 1999; Zhang, 2010).

Regardless of parents' plans for their children, there is a need for parents to be aware of how HLs typically develop, so that they might make informed parenting decisions concerning for example which language(s) to use at home and what schools or classes to enroll the child in. This thesis showed that more input has positive effects on the acquisition of the HL. Therefore, parents could help their children become more proficient in Cantonese, at least in morphosyntax and using frequency-dependent structures, by speaking more Cantonese at home and encouraging their children to use it as well. They could also create more opportunities for their children to interact

with more Cantonese speakers (in Cantonese) and be exposed to Cantonese, such as though enrolling them in community activities centered on the HL and its culture, or by introducing them to Cantonese media and pop culture and making Cantonese news programmes part of a daily routine.

In contrast, it is unlikely that parents can delay immigration solely for their children to live longer in the homeland and have a later AOA (also a significant predictor of accuracy of classifier selection). In a small number of cases, parents who have other reasons already to do so might consider waiting one year or even several before immigrating, although such a delay could have detrimental effects on the children's L2 development, not to mention their emotional and social needs. Bringing the HSs back to the homeland for holidays or an academic 'year abroad' could still be beneficial for HL acquisition as the HSs are exposed to periods of intensive Cantonese use. Of course, parents would also need to balance their preferences concerning their children's acquisition of the majority language while making decisions that would change the linguistic environment.

There was no consistent predictor of HL ability in terms of phonology, otherwise recommendations could be made with regards to how this aspect of HL development could be supported in young speakers. The results of this thesis in this aspect should be seen as a reflection of the difficulty in isolating the effect of individual factors on a heterogenous population and across domains, rather than a contradiction of previous research.

6.4.3 Methodology

The effectiveness of the materials employed in this thesis indicates that they can be applied to future research. The tone discrimination task (Chapter 3) and the picture-naming task (Chapter 5) were constructed using Opensesame and administered on a tablet. This method of delivering the testing was low-cost and paper-free, but more importantly it helped engage the young participants over the whole series of tasks. Initial concerns about some participants not having sufficient previous experience with electronic equipment proved to be unwarranted, and some participants were even distracted by the tablet and tried to use it during other tasks. While the strategy of presenting tasks as games is not new, it was instrumental in the collection of data here, in particular from the younger participants and the HSs.

Similarly, Qualtrics was successfully used to administer the rating task (Chapter 4). Web-based services have been used to administer questionnaires in many different fields, however Qualtrics could be used in even more linguistic research due to its ease of use, versatility, and the possibility of testing at distance. Having said that, the raters for this task were tested in person due to funding requirements, and despite the advantages of online testing, the LBQ was distributed in paper form in case not all parents had equal access to the Internet or were familiar with online surveys.

In the future, investment in the development of standardised tests can lead to a larger battery of tasks appropriate for Cantonese research. For example, the Cantonese

version of the PPVT used in this thesis was directly translated from the English original, and although it was piloted before testing began, its validity and reliability were not determined empirically, and age norms were also not established. Perhaps it is due to the spoken nature of Cantonese that standardised tests for Cantonese remain rare, although this should not be considered a limitation. Research methods should adapt to languages rather than the other way round, and doubtless many text-based measures of language ability (where relevant, e.g. not of spelling) can be adapted to be delivered aurally.

6.5 Conclusions

This thesis comprised three cross-sectional studies on the development of Cantonese of HSs in New York City. The results indicate some directions for further research. The LBQ could be expanded, as data on parents' and HSs' attitudes towards the HL could be used to explore the role of sociolinguistic factors on HL abilities. The measures of language use, especially with regards to the quantity of Cantonese used, could also be refined so as to further investigate how input and output affects the development of the HL. For example, in the current LBQ there was one question each for the proportion of Cantonese input and output with each interlocutor in the household, which could be expanded into several questions targeting different age periods of the HS, to be estimated in hours. However, it would be difficult to overcome the lower reliability of

parental or self-report without huge time costs for the researcher and/or parents.

The cross-sectional nature of the thesis naturally invites the alternative of a longitudinal study. While the HSs were relatively similar in background (e.g. attending the same schools, with parents of similar occupational status, living in the same neighbourhoods, attending the same after-school programme), the large variance in performance suggests that a longitudinal study would help illustrate the different developmental trajectories that the HL can take in individual speakers. Targeting siblings, parent-child pairs, or even entire households over a period of time would provide even more opportunities for insight into individual development, although this last grouping is more invasive of privacy and requires the long-term cooperation of participants. Future studies could also investigate sociolinguistic factors (e.g., Leung & Uchikoshi, 2012; Yang, 2007), which were not included in this thesis.

In terms of target feature, there are many more Cantonese properties and skills to explore, both perceptive and productive. One question not asked in this thesis was whether certain features or domains of HLs are more likely to become target-like. (Phonology and morphosyntax were both tested, but separately, and not compared.) Future research could address this question by employing tests of comparable nature (e.g. all productive), although reaching even a preliminary answer would probably require a large number of studies targeting a range of language pairs. The participants' English abilities could also be tested for a more complete and balanced understanding of the HSs' language development. Since both groups of participants were Cantonese-

English bilinguals, there was a good opportunity to compare the two groups in both of their languages and find out whether there is a trade-off effect. Unfortunately, it was beyond the scope of this thesis.

Overall, the results of the three studies converged well with previous research on young HSs in showing that some divergence can occur in childhood, and they also match up with research on adults in explaining divergences in adulthood. With the consistent differences between HSs and other speaker populations, future research can focus more on identifying which factors predict HL abilities and how they interact, so that practical recommendations can be made to the direct benefit of HSs and their parents.

Appendix A

Materials

A.1 Invitation letters to parents

University of Essex
Department of Language
and Linguistics

Colchester Campus, Wivenhoe Park
Colchester CO4 3SQ, United Kingdom
Tel: +44 (0)1206 872083
https://www.essex.ac.uk/langling/

Dear Parent/Guardian,

My name is Rachel Kan and I am a PhD student at the Department of Language and Linguistics, the University of Essex, under the supervision of Prof. Monika Schmid. I am writing to invite your child to take part in my research titled 'Development of Cantonese as a Heritage Language in Children'.

While families that speak Cantonese will use it at home, children will also come across it at school and in society. In Hong Kong, some children may be taught in Cantonese, while others are taught in English. For children living overseas, the home may be the only environment for them where Cantonese is used. The aim of my project is to investigate how children living in different countries learn Cantonese.

I am looking to recruit children in Primary 1-6. Your child will be asked to play a few language games on a tablet, and I will also ask a few questions about his/her family background. Your child's responses will be audio recorded or be recorded through the tablet. There is no writing or reading involved. Completing the tasks should take approximately 45 minutes. Depending on the arrangement with the school, your child's session may take place during or outside of school hours. If you agree to your child taking part but would like to make private arrangements for the meeting place or time, please contact me at tyrkan@essex.ac.uk.

Taking part in this research is completely voluntary. You are under no obligation to agree for your child to take part in this project. But your child's participation will be invaluable to the research that contributes to our knowledge of how children learn Cantonese.

Your child's performance in the language games will not be shared with his/her school, and will not be used in any form of assessment. Some of the data collected may be used in my thesis and related publications, to which there may be restricted access. However, all information and data collected will be confidential and made anonymous. This means that if you agree to your child's participating, your child will not be identified in any way. You can also ask for your child to leave the research at any stage, and he/she can also ask to leave at any point. Not participating in the study will not affect your child's education in any way. This study has been reviewed by the University of Essex Ethics Committee, and has received ethics clearance. All paper and electronic data will be stored in a locked room or a locked computer, and will only be accessible to me.

There will be an opportunity for your child to ask me questions before the start of the tasks. If you have any questions or would like to obtain more information, please contact me at tyrkan@essex.ac.uk. If you have concerns about the study at any point, please do not hesitate to contact me, and I will reply within a week. If you do not feel your concern is adequately addressed or you wish to make a formal complaint, please contact the University of Essex Department of Language and Linguistics Ethics Co-ordinator Dr. Mike Jones (majones@essex.ac.uk).

If you are interested in this study, please sign the attached consent form and return it to your child's teacher. Please also discuss the research with your child. Thank you very much for your kind attention. I hope to obtain your consent.

Yours sincerely,

Rachel Kan

A.2 Consent forms for children and parents

University of Essex
Department of Language
and Linguistics

Colchester Campus, Wivenhoe Park
Colchester CO4 3SQ, United Kingdom
Tel: +44 (0)1206 872083
https://www.essex.ac.uk/langling/

University of Essex

Parent/Guardian Consent Form for 'Development of Cantonese as a Heritage Language in Children'

Rachel KAN, PhD student at the University of Essex, is carrying out a study to investigate the development of Cantonese as a heritage language in children. The researcher can be contacted at tyrkan@essex.ac.uk.

Please tick the appropriate boxes.

☐ I am the parent/legal guardian of the child named below and give permission for him/her to be included in this research.

☐ I understand that my child's responses will be recorded, and that data collected will be used in the researcher's thesis and related publications.

☐ I understand that I may withdraw my child from the research at any stage. I understand that my child and his/her education will not be affected in any way should he/she be withdrawn from the research at any stage.

☐ I have read the information in the accompanying invitation letter and leaflet. I have had the opportunity to ask questions about this research, and any questions I have asked have been answered satisfactorily. I am satisfied with my understanding of the study, including: ethics clearance, who will have access to any personal data, and how data collected will be stored and treated.

☐ I understand that I can contact the researcher at the above e-mail address and I understand how to raise any concerns or make a complaint.

Student's name: _____

Class: _____

Parent's name: _____

Parent's signature: _____

Date: _____

Researcher's name: _____

Researcher's signature: _____

Date: _____

University of Essex
Department of Language
and Linguistics

Colchester Campus, Wivenhoe Park
Colchester CO4 3SQ, United Kingdom
Tel: +44 (0)1206 872083
https://www.essex.ac.uk/langling/

Consent Form for 'Development of Cantonese as a Heritage Language in Children'

Rachel KAN, PhD student at the University of Essex, is carrying out a study to investigate the development of Cantonese as a heritage language in children. The researcher can be contacted at tyrkan@essex.ac.uk.

Please tick the appropriate boxes.

☐ I agree to be included in this research, in connection with my child who is also taking part.

☐ I understand that my responses will be audio recorded, and that data collected will be used in the researcher's thesis and related publications.

☐ I understand that I may withdraw from the research at any stage. I understand that I, my child, and his/her education will not be affected in any way should I withdraw from the research at any stage.

☐ I have read the information in the accompanying invitation letter. I have had the opportunity to ask questions about this research, and any questions I have asked have been answered satisfactorily. I am satisfied with my understanding of the study, including: ethics clearance, who will have access to the personal data, and how data collected will be stored and treated.

☐ I understand that I can contact the researcher at the above e-mail address and I understand how to raise any concerns or make a complaint.

Parent's name: _____

Parent's signature: _____

Date: _____

Researcher's name: _____

Researcher's signature: _____

Date: _____

A.3 Initial survey for recruitment

Cantonese use survey [translation]

School: _____ Class: _____

Name: _____ Age: _____

1. Do you use Cantonese with your child at home?

☐ Often ☐ Sometimes ☐ No

2. How long has your child been in the United States?

☐ He was born and raised in the United States.

☐ 1-2 years ☐ 3-4 years ☐ 5-6 years

☐ 7-8 years ☐ 9-10 years ☐ >10 years

If you use Cantonese at home with your child, please continue with the survey.

3. Who speaks Cantonese at home? (Please select all that apply.)

☐ Father ☐ Mother ☐Grandfather ☐ Grandmother ☐ Other

4. How would you rate your child's ability to understand Cantonese?

☐ Very poor, he does not understand any Cantonese

☐ Poor, he only understands common phrases (e.g. greetings, commands, etc.)

☐ Fair, he understands simple, daily conversations

☐ Good, he understands difficult conversations (e.g. movie/TV dialogue)

☐ Very good, he understands Cantonese in any situation (e.g. lectures, reports)

5. How would you rate your child's ability to speak Cantonese?

☐ Very poor, he does not speak any Cantonese

☐ Poor, he only speaks a few words of Cantonese

☐ Fair, he can speak Cantonese in daily life situations (e.g. greetings, thanking people, speaking on the phone, etc.)

☐ Good, he can converse with others (e.g. parents, relatives and friends) in simple Cantonese

☐ Very good, he can converse fluently with anyone

Thank you!

A.4 Language background questionnaire

A.4.1 For participants from the United States

Language background questionnaire

I. Please write your responses on the lines where spaces are provided.
II. Please delete as appropriate when an asterisk (*) appears.
III. Where options are given, put a ✓in the appropriate box(es).
IV. 'Your child' refers to the one taking part in the project.

1. What is your child's name? _____

2. What is your child's date of birth? _____
DD/MM/YY

Where was your child born? _____
Country of birth

If your child was not born in the US, when did he/she move to US?

_____
DD/MM/YY

How many times has your child been to Hong Kong? _____

What language does your child use when in Hong Kong?

- □ Always Cantonese
- □ Usually Cantonese, sometimes another language
- □ Equal amounts of Cantonese and another language
- □ Usually another language, sometimes Cantonese
- □ Always another language, not Cantonese

The other language is: *English/Putonghua/Other (please specify_____)

3. How did your child first come into contact with Cantonese?
Tick up to 3 boxes.

- □ Mother/Father/Guardian
- □ Sibling(s)
- □ Grandparent(s)
- □ Nursery/Daycare
- □ Babysitter/Domestic helper
- □ Primary School
- □ Language Class
- □ Other members of community

4. When did your child start hearing Cantonese regularly?

- □ From birth - 1 year old
- □ Between the age of 1-2
- □ Between the age of 2-3
- □ Between the age of 3-6
- □ After 6 years old

5. How well does your child understand spoken Cantonese?

- □ Cannot understand any Cantonese words
- □ Can understand every day expressions and basic phrases (e.g. greetings)
- □ Can understand simple conversations (e.g. following simple instructions)
- □ Can understand complex conversations (e.g. films, TV shows)
- □ Can understand almost everything in almost every situation
- □ Can understand everything appropriate to his/her age easily

6. How well does your child speak Cantonese?

- □ Cannot speak any Cantonese words
- □ Can say a few words (e.g. naming common objects)
- □ Can participate in simple conversations (e.g. answering the phone, basic greetings)
- □ Can participate in informal conversations (e.g. chatting with friends and parents)
- □ Can speak in formal situations (e.g. giving a short speech)
- □ Can speak fluently in every situation

Does your child read and/or write Chinese? If yes, please continue with the following question. If no, please go to Question 11.

7. How well does your child read Chinese?

- □ Cannot read any Chinese words
- □ Can recognize a few Chinese words
- □ Can read simple texts (e.g. food labels, direction signs, common names made up of simple words)
- □ Can read short texts (e.g. stories for children)
- □ Can read longer texts (e.g. novels for youths)
- □ Can read complex texts (e.g. newspaper articles, long essays)

8. How well does your child write in Chinese?

- □ Cannot write any Chinese words
- □ Can write a few Chinese words (e.g. one's name, some other simple characters)
- □ Can write simple texts (e.g. simple expressions made up of a few words)
- □ Can write short texts (e.g. messages containing a few simple sentences)
- □ Can write longer texts (e.g. a paragraph of text letter/ an email containing a few short paragraphs)
- □ Can write complex texts (e.g. letters, essays)

9. Where did your child learn to read/write Chinese?
You may tick more than one.

- □ At school
- □ At home
- □ At Chinese language classes

10. In what language did your child learn to read/write Chinese?

- □ Cantonese
- □ Putonghua
- □ Both Cantonese and Putonghua

11. Tick all the statements that apply:

- □ My child has always been using the same amount of Cantonese at home.
- □ My child uses Cantonese at home more often now compared to when he/she was younger.
- □ My child uses Cantonese at home less often now compared to when he/she was younger.

12. How did your child first come into contact with English?
Tick up to 3 boxes.

- □ Mother/Father/Guardian
- □ Sibling(s)
- □ Grandparent(s)
- □ Nursery/Daycare
- □ Babysitter/Domestic helper
- □ Primary School
- □ Language Class
- □ Other members of community

13. When did your child start hearing English regularly?

- □ From birth - 1 year old
- □ Between the age of 1-2
- □ Between the age of 2-3
- □ Between the age of 3-6
- □ After 6 years old

14. How well does your child understand spoken English?

- □ Cannot understand any English words
- □ Can understand every day expressions and basic phrases (e.g. greetings)
- □ Can understand simple conversations (e.g. following simple instructions)
- □ Can understand complex conversations (e.g. films, TV shows
- □ Can understand almost everything in almost every situation
- □ Can understand everything appropriate to his/her age easily

15. How well does your child speak English?

- □ Cannot speak any English words
- □ Can say a few words (e.g. naming common objects)
- □ Can participate in simple conversations (e.g. answering the phone, basic greetings)
- □ Can participate in informal conversations (e.g. chatting with friends and parents)
- □ Can speak in formal situations (e.g. giving a short speech)
- □ Can speak fluently in every situation

If your child has had contact with any languages other than Cantonese and English, please continue with the following question. If not, please go to Question 17.

16. My child also speaks:_____

How did your child first come into contact with this other language?
Tick up to 3 boxes.

- ☐ Mother/Father/Guardian
- ☐ Sibling(s)
- ☐ Grandparent(s)
- ☐ Nursery/Daycare
- ☐ Babysitter/Domestic helper
- ☐ Primary School
- ☐ Language Class
- ☐ Other members of community

When did your child start hearing this other language regularly?

- ☐ From birth - 1 year old
- ☐ Between the age of 1-2
- ☐ Between the age of 2-3
- ☐ Between the age of 3-6
- ☐ After 6 years old

How well does your child understand this other language (spoken)?

- ☐ Cannot understand any words in this language
- ☐ Can understand every day expressions and basic phrases (e.g. greetings)
- ☐ Can understand simple conversations (e.g. following simple instructions)
- ☐ Can understand complex conversations (e.g. films, TV shows
- ☐ Can understand almost everything in almost every situation
- ☐ Can understand everything appropriate to his/her age easily

How well does your child speak this other language?

- ☐ Can say a few words (e.g. naming common objects)
- ☐ Can participate in simple conversations (e.g. answering the phone, basic greetings)
- ☐ Can participate in informal conversations (e.g. chatting with friends and parents)
- ☐ Can speak in formal situations (e.g. giving a short speech)
- ☐ Can speak fluently in every situation

If your child speaks more than 1 other language, please ask for an extra response sheet for Question 16.

17. Father/First guardian

What is his occupation? _____

What is his highest level of education completed?

- □ Secondary
- □ Undergraduate
- □ Postgraduate
- □ Vocational/Professional
- □ Prefer not to say

Where was he born? _____

How well does he understand spoken Cantonese?

- □ Cannot understand any Cantonese words
- □ Can understand every day expressions and basic phrases (e.g. greetings)
- □ Can understand simple conversations (e.g. following simple instructions)
- □ Can understand complex conversations (e.g. films, TV shows
- □ Can understand almost everything in almost every situation
- □ Can understand everything easily

How well does he speak Cantonese?

- □ Cannot speak any Cantonese words
- □ Can say a few words (e.g. naming common objects)
- □ Can participate in simple conversations (e.g. answering the phone, basic greetings)
- □ Can participate in informal conversations (e.g. chatting with friends)
- □ Can speak in formal situations (e.g. giving a short speech)
- □ Can speak fluently in every situation

What language(s) does he speak at home?

- □ Always Cantonese
- □ Usually Cantonese, sometimes another language
- □ Equal amounts of Cantonese and another language
- □ Usually another language, sometimes Cantonese
- □ Always another language, not Cantonese

The other language is: *English/Putonghua/Other (please specify_____)

What language(s) does your child use to speak with his/her father?

- □ Always Cantonese
- □ Usually Cantonese, sometimes another language
- □ Equal amounts of Cantonese and another language
- □ Usually another language, sometimes Cantonese
- □ Always another language, not Cantonese

The other language is: *English/Putonghua/Other (please specify_____)

18. Mother/Second guardian

What is her occupation? _____

What is her highest level of education completed?

- □ Secondary
- □ Undergraduate
- □ Postgraduate
- □ Vocational/Professional
- □ Prefer not to say

Where was she born? _____

How well does she understand spoken Cantonese?

- □ Cannot understand any Cantonese words
- □ Can understand every day expressions and basic phrases (e.g. greetings)
- □ Can understand simple conversations (e.g. following simple instructions)
- □ Can understand complex conversations (e.g. films, TV shows
- □ Can understand almost everything in almost every situation
- □ Can understand everything easily

How well does she speak Cantonese?

- □ Cannot speak any Cantonese words
- □ Can say a few words (e.g. naming common objects)
- □ Can participate in simple conversations (e.g. answering the phone, basic greetings)
- □ Can participate in informal conversations (e.g. chatting with friends)
- □ Can speak in formal situations (e.g. giving a short speech)
- □ Can speak fluently in every situation

What language(s) does she speak at home?

- □ Always Cantonese
- □ Usually Cantonese, sometimes another language
- □ Equal amounts of Cantonese and another language
- □ Usually another language, sometimes Cantonese
- □ Always another language, not Cantonese

The other language is: *English/Putonghua/Other (please specify_____)

What language(s) does your child use to speak with his/her mother?

- □ Always Cantonese
- □ Usually Cantonese, sometimes another language
- □ Equal amounts of Cantonese and another language
- □ Usually another language, sometimes Cantonese
- □ Always another language, not Cantonese

The other language is: *English/Putonghua/Other (please specify_____)

Does your child have any sisters or brothers? If yes, please continue with the following question. If no, please go to Question 20.

19. Sibling 1: What is his/her date of birth? _____
DD/MM/YY

Where was he/she born? _____
Country of birth

When did this sibling start receiving consistent and significant exposure to Cantonese?

- □ From birth - 1 year old
- □ Between the age of 1-2
- □ Between the age of 2-3
- □ Between the age of 3-6
- □ After 6 years old

How well does this sibling understand spoken Cantonese?

- □ Cannot understand any Cantonese words
- □ Can understand every day expressions and basic phrases (e.g. greetings)
- □ Can understand simple conversations (e.g. following simple instructions)
- □ Can understand complex conversations (e.g. films, TV shows
- □ Can understand almost everything in almost every situation
- □ Can understand everything appropriate to his/her age easily

How well does this sibling speak Cantonese?

- □ Cannot speak any Cantonese words
- □ Can say a few words (e.g. naming common objects)
- □ Can participate in simple conversations (e.g. answering the phone, basic greetings)
- □ Can participate in informal conversations (e.g. chatting with friends and parents)
- □ Can speak in formal situations (e.g. giving a short speech)
- □ Can speak fluently in every situation

What language(s) does this sibling speak at home?

- □ Always Cantonese
- □ Usually Cantonese, sometimes another language
- □ Equal amounts of Cantonese and another language
- □ Usually another language, sometimes Cantonese
- □ Always another language, not Cantonese

The other language is: *English/Putonghua/Other (please specify_____)

What language(s) does your child use to speak with this sibling?

- □ Always Cantonese
- □ Usually Cantonese, sometimes another language
- □ Equal amounts of Cantonese and another language
- □ Usually another language, sometimes Cantonese
- □ Always another language, not Cantonese

The other language is: *English/Putonghua/Other (please specify_____)

If your child has more than 1 sibling, please ask for an extra response sheet for Question 19.

Are there other people who have regular contact with your child at home? If yes, please continue with the following question. If no, please go to Question 21.

20. What is this person's relation to your child? _____

How well does this person understand spoken Cantonese?

- □ Cannot understand any Cantonese words
- □ Can understand every day expressions and basic phrases (e.g. greetings)
- □ Can understand simple conversations (e.g. following simple instructions)
- □ Can understand complex conversations (e.g. films, TV shows
- □ Can understand almost everything in almost every situation
- □ Can understand everything easily

How well does this person speak Cantonese?

- □ Cannot speak any Cantonese words
- □ Can say a few words (e.g. naming common objects)
- □ Can participate in simple conversations (e.g. answering the phone, basic greetings)
- □ Can participate in informal conversations (e.g. chatting with friends)
- □ Can speak in formal situations (e.g. giving a short speech)
- □ Can speak fluently in every situation

What language(s) does this person speak at home?

- □ Always Cantonese
- □ Usually Cantonese, sometimes another language
- □ Equal amounts of Cantonese and another language
- □ Usually another language, sometimes Cantonese
- □ Always another language, not Cantonese

The other language is: *English/Putonghua/Other (please specify_____)

What language(s) does your child use to speak with this person?

- □ Always Cantonese
- □ Usually Cantonese, sometimes another language
- □ Equal amounts of Cantonese and another language
- □ Usually another language, sometimes Cantonese
- □ Always another language, not Cantonese

The other language is: *English/Putonghua/Other (please specify_____)

If there are more people having regular contact with your child at home, please ask for an extra response sheet for Question 20.

21. At school

What language(s) is spoken by the teachers at your child's school?

- □ Always Cantonese
- □ Usually Cantonese, sometimes another language
- □ Equal amounts of Cantonese and another language
- □ Usually another language, sometimes Cantonese
- □ Always another language, not Cantonese

The other language is: *English/Putonghua/Other (please specify_____)

What language(s) does your child use to speak with other children at school?

- □ Always Cantonese
- □ Usually Cantonese, sometimes another language
- □ Equal amounts of Cantonese and another language
- □ Usually another language, sometimes Cantonese
- □ Always another language, not Cantonese

The other language is: *English/Putonghua/Other (please specify_____)

Does your child have Chinese lessons at school?

- □ Yes
- □ No

If yes, which Chinese language(s) does your child learn at school?

- □ Always Cantonese
- □ Usually Cantonese, sometimes Putonghua
- □ Equal amounts of Cantonese and Putonghua
- □ Usually Putonghua, sometimes Cantonese
- □ Always Putonghua, not Cantonese

22. Chinese language classes

These refer to classes that take place outside of school. Please skip if your child does not take part such classes.

Which of the following is/are your child learning?

- □ Cantonese
- □ Putonghua
- □ Both Cantonese and Putonghua

What language(s) does your child use to speak with other children during these classes?

- □ Always Cantonese
- □ Usually Cantonese, sometimes another language
- □ Equal amounts of Cantonese and another language
- □ Usually another language, sometimes Cantonese
- □ Always another language, not Cantonese

The other language is: *English/Putonghua/Other (please specify_____)

23. Activities

What language does your child use when playing sports?

- □ Always Cantonese
- □ Usually Cantonese, sometimes another language
- □ Equal amounts of Cantonese and another language
- □ Usually another language, sometimes Cantonese
- □ Always another language, not Cantonese
- □ Not applicable

The other language is: *English/Putonghua/Other (please specify_____)

What language does your child use when taking part in religious activities (e.g. going to church)?

- □ Always Cantonese
- □ Usually Cantonese, sometimes another language
- □ Equal amounts of Cantonese and another language
- □ Usually another language, sometimes Cantonese
- □ Always another language, not Cantonese
- □ Not applicable

The other language is: *English/Putonghua/Other (please specify_____)

What language does your child use to speak with friends outside school?

- □ Always Cantonese
- □ Usually Cantonese, sometimes another language
- □ Equal amounts of Cantonese and another language
- □ Usually another language, sometimes Cantonese
- □ Always another language, not Cantonese
- □ Not applicable

The other language is: *English/Putonghua/Other (please specify_____)

What language does your child watch TV in?

- □ Always Cantonese
- □ Usually Cantonese, sometimes another language
- □ Equal amounts of Cantonese and another language
- □ Usually another language, sometimes Cantonese
- □ Always another language, not Cantonese
- □ Not applicable

The other language is: *English/Putonghua/Other (please specify_____)

What language does your child use the computer in?

- □ Always Chinese (Cantonese)
- □ Usually Chinese (Cantonese), sometimes another language
- □ Equal amounts of Chinese (Cantonese) and another language
- □ Usually another language, sometimes Chinese (Cantonese)
- □ Always another language, not Chinese (Cantonese)
- □ Not applicable

The other language is: *English/Putonghua/Other (please specify_____)

Does your child play any musical instruments?

- □ Yes
- □ No

Does your child take part in singing classes or choirs?

- □ Yes
- □ No

This is the end of the questionnaire. Thank you very much for your time!

A.4.2 For participants from Hong Kong

Language background questionnaire

I. Please write your responses on the lines where spaces are provided.
II. Please delete as appropriate when an asterisk (*) appears.
III. Where options are given, put a ✓ in the appropriate box(es).
IV. 'Your child' refers to the one taking part in the project.

1. What is your child's name? _____

2. What is your child's date of birth? _____
DD/MM/YY

Where was your child born? _____
Country of birth

If your child was not born in Hong Kong, when did he/she move to Hong Kong?

_____
DD/MM/YY

3. How did your child first come into contact with Cantonese?
Tick up to 3 boxes.

- □ Mother/Father/Guardian
- □ Sibling(s)
- □ Grandparent(s)
- □ Nursery/Daycare
- □ Babysitter/Domestic helper
- □ Primary School
- □ Language Class
- □ Other members of community

4. When did your child start hearing Cantonese regularly?

- □ From birth - 1 year old
- □ Between the age of 1-2
- □ Between the age of 2-3
- □ Between the age of 3-6
- □ After 6 years old

5. How well does your child understand spoken Cantonese?

- □ Cannot understand any Cantonese words
- □ Can understand every day expressions and basic phrases (e.g. greetings)
- □ Can understand simple conversations (e.g. following simple instructions)
- □ Can understand complex conversations (e.g. films, TV shows)
- □ Can understand almost everything in almost every situation
- □ Can understand everything appropriate to his/her age easily

6. How well does your child speak Cantonese?

- □ Cannot speak any Cantonese words
- □ Can say a few words (e.g. naming common objects)
- □ Can participate in simple conversations (e.g. answering the phone, basic greetings)
- □ Can participate in informal conversations (e.g. chatting with friends and parents)
- □ Can speak in formal situations (e.g. giving a short speech)
- □ Can speak fluently in every situation

Does your child read and/or write Chinese? If yes, please continue with the following question. If no, please go to Question 11.

7. How well does your child read Chinese?

- □ Cannot read any Chinese words
- □ Can recognize a few Chinese words
- □ Can read simple texts (e.g. food labels, direction signs, common names made up of simple words)
- □ Can read short texts (e.g. stories for children)
- □ Can read longer texts (e.g. novels for youths)
- □ Can read complex texts (e.g. newspaper articles, long essays)

8. How well does your child write in Chinese?

- □ Cannot write any Chinese words
- □ Can write a few Chinese words (e.g. one's name, some other simple characters)
- □ Can write simple texts (e.g. simple expressions made up of a few words)
- □ Can write short texts (e.g. messages containing a few simple sentences)
- □ Can write longer texts (e.g. a paragraph of text letter/ an email containing a few short paragraphs)
- □ Can write complex texts (e.g. letters, essays)

9. Where did your child learn to read/write Chinese?
You may tick more than one.

- □ At school
- □ At home
- □ At Chinese language classes

10. In what language did your child learn to read/write Chinese?

- □ Cantonese
- □ Putonghua
- □ Both Cantonese and Putonghua

11. Tick all the statements that apply:

- □ My child has always been using the same amount of Cantonese at home.
- □ My child uses Cantonese at home more often now compared to when he/she was younger.
- □ My child uses Cantonese at home less often now compared to when he/she was younger.

12. How did your child first come into contact with English?
Tick up to 3 boxes.

- □ Mother/Father/Guardian
- □ Sibling(s)
- □ Grandparent(s)
- □ Nursery/Daycare
- □ Babysitter/Domestic helper
- □ Primary School
- □ Language Class
- □ Other members of community

13. When did your child start hearing English regularly?

- □ From birth - 1 year old
- □ Between the age of 1-2
- □ Between the age of 2-3
- □ Between the age of 3-6
- □ After 6 years old

14. How well does your child understand spoken English?

- □ Cannot understand any English words
- □ Can understand every day expressions and basic phrases (e.g. greetings)
- □ Can understand simple conversations (e.g. following simple instructions)
- □ Can understand complex conversations (e.g. films, TV shows
- □ Can understand almost everything in almost every situation
- □ Can understand everything appropriate to his/her age easily

15. How well does your child speak English?

- □ Cannot speak any English words
- □ Can say a few words (e.g. naming common objects)
- □ Can participate in simple conversations (e.g. answering the phone, basic greetings)
- □ Can participate in informal conversations (e.g. chatting with friends and parents)
- □ Can speak in formal situations (e.g. giving a short speech)
- □ Can speak fluently in every situation

If your child has had contact with any languages other than Cantonese and English, please continue with the following question. If not, please go to Question 17.

16. My child also speaks:_____

How did your child first come into contact with this other language?
Tick up to 3 boxes.

- ☐ Mother/Father/Guardian
- ☐ Sibling(s)
- ☐ Grandparent(s)
- ☐ Nursery/Daycare
- ☐ Babysitter/Domestic helper
- ☐ Primary School
- ☐ Language Class
- ☐ Other members of community

When did your child start hearing this other language regularly?

- ☐ From birth - 1 year old
- ☐ Between the age of 1-2
- ☐ Between the age of 2-3
- ☐ Between the age of 3-6
- ☐ After 6 years old

How well does your child understand this other language (spoken)?

- ☐ Cannot understand any words in this language
- ☐ Can understand every day expressions and basic phrases (e.g. greetings)
- ☐ Can understand simple conversations (e.g. following simple instructions)
- ☐ Can understand complex conversations (e.g. films, TV shows
- ☐ Can understand almost everything in almost every situation
- ☐ Can understand everything easily

How well does your child speak this other language?

- ☐ Can say a few words (e.g. naming common objects)
- ☐ Can participate in simple conversations (e.g. answering the phone, basic greetings)
- ☐ Can participate in informal conversations (e.g. chatting with friends and parents)
- ☐ Can speak in formal situations (e.g. giving a short speech)
- ☐ Can speak fluently in every situation

If your child speaks more than 1 other language, please ask for an extra response sheet for Question 16.

17. Father/First guardian

What is his occupation? _____

What is his highest level of education completed?

- □ Secondary
- □ Undergraduate
- □ Postgraduate
- □ Vocational/Professional
- □ Prefer not to say

Where was he born? _____

How well does he understand spoken Cantonese?

- □ Cannot understand any Cantonese words
- □ Can understand every day expressions and basic phrases (e.g. greetings)
- □ Can understand simple conversations (e.g. following simple instructions)
- □ Can understand complex conversations (e.g. films, TV shows
- □ Can understand almost everything in almost every situation
- □ Can understand everything easily

How well does he speak Cantonese?

- □ Cannot speak any Cantonese words
- □ Can say a few words (e.g. naming common objects)
- □ Can participate in simple conversations (e.g. answering the phone, basic greetings)
- □ Can participate in informal conversations (e.g. chatting with friends)
- □ Can speak in formal situations (e.g. giving a short speech)
- □ Can speak fluently in every situation

What language(s) does he speak at home?

- □ Always Cantonese
- □ Usually Cantonese, sometimes another language
- □ Equal amounts of Cantonese and another language
- □ Usually another language, sometimes Cantonese
- □ Always another language, not Cantonese

The other language is: *English/Putonghua/Other (please specify_____)

What language(s) does your child use to speak with his/her father?

- □ Always Cantonese
- □ Usually Cantonese, sometimes another language
- □ Equal amounts of Cantonese and another language
- □ Usually another language, sometimes Cantonese
- □ Always another language, not Cantonese

The other language is: *English/Putonghua/Other (please specify_____)

18. Mother/Second guardian

What is her occupation? _____

What is her highest level of education completed?

- □ Secondary
- □ Undergraduate
- □ Postgraduate
- □ Vocational/Professional
- □ Prefer not to say

Where was she born? _____

How well does she understand spoken Cantonese?

- □ Cannot understand any Cantonese words
- □ Can understand every day expressions and basic phrases (e.g. greetings)
- □ Can understand simple conversations (e.g. following simple instructions)
- □ Can understand complex conversations (e.g. films, TV shows
- □ Can understand almost everything in almost every situation
- □ Can understand everything easily

How well does she speak Cantonese?

- □ Cannot speak any Cantonese words
- □ Can say a few words (e.g. naming common objects)
- □ Can participate in simple conversations (e.g. answering the phone, basic greetings)
- □ Can participate in informal conversations (e.g. chatting with friends)
- □ Can speak in formal situations (e.g. giving a short speech)
- □ Can speak fluently in every situation

What language(s) does she speak at home?

- □ Always Cantonese
- □ Usually Cantonese, sometimes another language
- □ Equal amounts of Cantonese and another language
- □ Usually another language, sometimes Cantonese
- □ Always another language, not Cantonese

The other language is: *English/Putonghua/Other (please specify_____)

What language(s) does your child use to speak with his/her mother?

- □ Always Cantonese
- □ Usually Cantonese, sometimes another language
- □ Equal amounts of Cantonese and another language
- □ Usually another language, sometimes Cantonese
- □ Always another language, not Cantonese

The other language is: *English/Putonghua/Other (please specify_____)

Does your child have any sisters or brothers? If yes, please continue with the following question. If no, please go to Question 20.

19. Sibling 1: What is his/her date of birth? _____
DD/MM/YY

Where was he/she born? _____
Country of birth

When did this sibling start receiving consistent and significant exposure to Cantonese?

- □ From birth - 1 year old
- □ Between the age of 1-2
- □ Between the age of 2-3
- □ Between the age of 3-6
- □ After 6 years old

How well does this sibling understand spoken Cantonese?

- □ Cannot understand any Cantonese words
- □ Can understand every day expressions and basic phrases (e.g. greetings)
- □ Can understand simple conversations (e.g. following simple instructions)
- □ Can understand complex conversations (e.g. films, TV shows
- □ Can understand almost everything in almost every situation
- □ Can understand everything appropriate to his/her age easily

How well does this sibling speak Cantonese?

- □ Cannot speak any Cantonese words
- □ Can say a few words (e.g. naming common objects)
- □ Can participate in simple conversations (e.g. answering the phone, basic greetings)
- □ Can participate in informal conversations (e.g. chatting with friends and parents)
- □ Can speak in formal situations (e.g. giving a short speech)
- □ Can speak fluently in every situation

What language(s) does this sibling speak at home?

- □ Always Cantonese
- □ Usually Cantonese, sometimes another language
- □ Equal amounts of Cantonese and another language
- □ Usually another language, sometimes Cantonese
- □ Always another language, not Cantonese

The other language is: *English/Putonghua/Other (please specify_____)

What language(s) does your child use to speak with this sibling?

- □ Always Cantonese
- □ Usually Cantonese, sometimes another language
- □ Equal amounts of Cantonese and another language
- □ Usually another language, sometimes Cantonese
- □ Always another language, not Cantonese

The other language is: *English/Putonghua/Other (please specify_____)

If your child has more than 1 sibling, please ask for an extra response sheet for Question 19.

Are there other people who have regular contact with your child at home? If yes, please continue with the following question. If no, please go to Question 21.

20. What is this person's relation to your child? _____

How well does this person understand spoken Cantonese?

- ☐ Cannot understand any Cantonese words
- ☐ Can understand every day expressions and basic phrases (e.g. greetings)
- ☐ Can understand simple conversations (e.g. following simple instructions)
- ☐ Can understand complex conversations (e.g. films, TV shows
- ☐ Can understand almost everything in almost every situation
- ☐ Can understand everything easily

How well does this person speak Cantonese?

- ☐ Cannot speak any Cantonese words
- ☐ Can say a few words (e.g. naming common objects)
- ☐ Can participate in simple conversations (e.g. answering the phone, basic greetings)
- ☐ Can participate in informal conversations (e.g. chatting with friends)
- ☐ Can speak in formal situations (e.g. giving a short speech)
- ☐ Can speak fluently in every situation

What language(s) does this person speak at home?

- ☐ Always Cantonese
- ☐ Usually Cantonese, sometimes another language
- ☐ Equal amounts of Cantonese and another language
- ☐ Usually another language, sometimes Cantonese
- ☐ Always another language, not Cantonese

The other language is: *English/Putonghua/Other (please specify_____)

What language(s) does your child use to speak with this person?

- ☐ Always Cantonese
- ☐ Usually Cantonese, sometimes another language
- ☐ Equal amounts of Cantonese and another language
- ☐ Usually another language, sometimes Cantonese
- ☐ Always another language, not Cantonese

The other language is: *English/Putonghua/Other (please specify_____)

If there are more people having regular contact with your child at home, please ask for an extra response sheet for Question 20.

21. At school

What language(s) is spoken by the teachers at your child's school?

- □ Always Cantonese
- □ Usually Cantonese, sometimes another language
- □ Equal amounts of Cantonese and another language
- □ Usually another language, sometimes Cantonese
- □ Always another language, not Cantonese

The other language is: *English/Putonghua/Other (please specify_____)

What language(s) does your child use to speak with other children at school?

- □ Always Cantonese
- □ Usually Cantonese, sometimes another language
- □ Equal amounts of Cantonese and another language
- □ Usually another language, sometimes Cantonese
- □ Always another language, not Cantonese

The other language is: *English/Putonghua/Other (please specify_____)

Does your child have Chinese lessons at school?

- □ Yes
- □ No

If yes, which Chinese language(s) does your child learn at school?

- □ Always Cantonese
- □ Usually Cantonese, sometimes Putonghua
- □ Equal amounts of Cantonese and Putonghua
- □ Usually Putonghua, sometimes Cantonese
- □ Always Putonghua, not Cantonese

22. Chinese language classes

These refer to classes that take place outside of school, e.g. private tutorial lessons. Please skip if your child does not take part such classes.

Which of the following is/are your child take Chinese language classes in?

- □ Cantonese
- □ Putonghua
- □ Both Cantonese and Putonghua

What language(s) does your child use to speak with other children during these classes?

- □ Always Cantonese
- □ Usually Cantonese, sometimes another language
- □ Equal amounts of Cantonese and another language
- □ Usually another language, sometimes Cantonese
- □ Always another language, not Cantonese

The other language is: *English/Putonghua/Other (please specify_____)

23. Activities

What language does your child use when playing sports?

- □ Always Cantonese
- □ Usually Cantonese, sometimes another language
- □ Equal amounts of Cantonese and another language
- □ Usually another language, sometimes Cantonese
- □ Always another language, not Cantonese
- □ Not applicable

The other language is: *English/Putonghua/Other (please specify_____)

What language does your child use when taking part in religious activities (e.g. going to church)?

- □ Always Cantonese
- □ Usually Cantonese, sometimes another language
- □ Equal amounts of Cantonese and another language
- □ Usually another language, sometimes Cantonese
- □ Always another language, not Cantonese
- □ Not applicable

The other language is: *English/Putonghua/Other (please specify_____)

What language does your child use to speak with friends outside school?

- □ Always Cantonese
- □ Usually Cantonese, sometimes another language
- □ Equal amounts of Cantonese and another language
- □ Usually another language, sometimes Cantonese
- □ Always another language, not Cantonese
- □ Not applicable

The other language is: *English/Putonghua/Other (please specify_____)

What language does your child watch TV in?

- □ Always Cantonese
- □ Usually Cantonese, sometimes another language
- □ Equal amounts of Cantonese and another language
- □ Usually another language, sometimes Cantonese
- □ Always another language, not Cantonese
- □ Not applicable

The other language is: *English/Putonghua/Other (please specify_____)

What language does your child use the computer in?

- □ Always Chinese (Cantonese)
- □ Usually Chinese (Cantonese), sometimes another language
- □ Equal amounts of Chinese (Cantonese) and another language
- □ Usually another language, sometimes Chinese (Cantonese)
- □ Always another language, not Chinese (Cantonese)
- □ Not applicable

The other language is: *English/Putonghua/Other (please specify_____)

Does your child play any musical instruments?

- □ Yes
- □ No

Does your child take part in singing classes or choirs?

- □ Yes
- □ No

This is the end of the questionnaire. Thank you very much for your time!

A.5 Rating task for adult L1 speakers

Listen to the following sound file

How native-like does this speaker sound?

- 1 : completely native-like
- 2
- 3
- 4
- 5
- 6 : not native-like at all

How well did you understand what this speaker was saying?

- 1 : extremely well
- 2
- 3
- 4
- 5
- 6 : not well at all

Where do you think this speaker is from?

- Cantonese-speaking parts of China (e.g. Guangzhou, Shenzhen)
- Non-Cantonese-speaking parts of China (e.g. Beijing)
- Hong Kong
- Overseas (e.g. USA)

A.6 Picture naming task

Target classifier	Object	Object (Cantonese)	Image
個 *go3*	Apple	蘋果 *ping4gwo2*	
	(Foot)ball	足球 *zuk1kau4* / 波 *bo1*	
	(Paper) bag	(紙)袋 *(zi2)doi2*	
張 *zoeng2*	Bed	床 *cong4*	
	Chair	凳 *dang3*	
	Table	檯 *toi2*	
粒 *lap1*	Peanut	花生 *faa1sang1*	
	Strawberry	士多啤梨 *si6do1be1lei2*	
	Button	鈕 *lau2*	
隻 *zek3*	Hand	手 *sau2*	
	Horse	馬 *maa5*	
	Butterfly	蝴蝶 *wu4dip2*	

Target classifier	Object	Object (Cantonese)	Image
條 *tiu4*	Fish	魚 *jyu2*	
	Trousers	褲 *fu3*	
	Key	鑰匙 *so2si4*	
把 *baa2*	Scissors	鉸剪 *gaau3zin2*	
	Knife	刀 *dou1*	
	(Beach) umbrella	(太陽) 傘 *(taai3jeong4) saan3* / (沙灘) 遮 *(saa1taan1) ze1*	

Table A.1 The stimuli and images used in the picture-naming task

Appendix B

Results

B.1 Chapter 4

Speaker	High ratings			Low ratings		
	HS1	HS2	HS3	HS4	HS5	HS6
Scores						
Native-likeness	1.73	1.8	1.77	4.67	4.5	4
Comprehensibility	1.83	1.67	2.23	3.93	3.87	4.1
Classification						
Option with the most votes	Hong Kong	Hong Kong	Hong Kong	United States	United States	Beijing
No. votes	18	21	21	13	18	13
(%)	60	70	70	43.33	60	43.33
Linguistic background						
Gender	F	M	F	M	F	F
Birthplace	United States	United States	United States	United States	United States	Hong Kong
AOT	6;7	8;9	8;1	6;11	10;7	9;2
AOA	0	0	0	0	0	5;5
LOR	-	-	-	-	-	3;7
Visits to China	0	0	2	0	0	0
Literate in Chinese	No	Yes	Yes	No	-	No
Other languages spoken	-	Mandarin, French	-	-	-	Spanish
Father's place of birth	China	China	Hong Kong	China	-	China (Taishan)
Mother's place of birth	China	China	Hong Kong	China	-	China (Taishan)
Father's occupation	Accountant	-	Driver	Waiter	-	Chef
Mother's occupation	-	-	Secretary	Domestic helper	Community worker	Cashier
Father's education	-	Secondary	Secondary	Secondary	-	Vocational
Mother's education	-	Secondary	Secondary	Secondary	-	Vocational

Speaker	High ratings			Low ratings		
	HS1	HS2	HS3	HS4	HS5	HS6
Father's self-rated Cantonese listening	6	6	6	6	-	6
Father's self-rated Cantonese speaking	6	6	6	6	-	6
Mother's self-rated Cantonese listening	6	5	6	6	-	6
Mother's self-rated Cantonese speaking	6	6	6	6	-	5
Father's proportion of Cantonese use with child (%)	75	100	100	100	100	75
Child's proportion of Cantonese use with father (%)	50	100	75	100	100	75
Mother's proportion of Cantonese use with child (%)	75	100	100	100	100	25
Child's proportion of Cantonese use with mother (%)	75	75	75	100	100	25
Siblings	1 younger	0	1 older	-	1 older	0
Proportion of Cantonese use between siblings (%)	75	-	100	-	0	-
Other adults living in the same household	-	-	Grandparents	-	-	-
Proportion of Cantonese used to teach in school (%)	0	0	0	-	0	0
Proportion of Cantonese used with classmates in school (%)	0	0	0	-	0	0

Speaker	High ratings			Low ratings		
	HS1	HS2	HS3	HS4	HS5	HS6
Attending extracurricular Chinese classes	No	-	Yes	Yes	No	No
Proportion of Cantonese used when... (%)						
Playing sports	0	-	50	-	-	0
Talking to friends	25	-	0	-	0	0
Watching TV	25	-	50	-	0	50
Using the computer	0	-	0	-	0	0

Table B.1 Scores and language background of the HSs included in the qualitative analysis

	HS1	HS2	HS3	HS4	HS5	HS6
No. mistakes	1	1	0	2	2	3
Word count	27	25	29	29	24	24
Words per second	2.62	2.23	2.87	2.18	1.97	2.09

Table B.2 Description of samples

The following is a transcript of the samples for the speakers included in the qualitative analysis (p.124). There are six samples, for HS1–6. The first two lines are transcriptions of the utterances in Chinese characters and jyutping respectively. The transcription was produced based on target utterances and does not reflect actual production. The third line is an English translation of the utterance.

(15) 然之後 個 男仔 唔 知 係² 邊度 呀
jin4zi1hau6 go3 naam4zai2 m4 zi1 hai2 bin1dou6 aa3
'and then the boy was somewhere' (the narrator doesn't know where)
然之後 個 男仔 跌
jin4zi1hau6 go3 naam4zai2 dit3
'and then the boy fell'
*然之後 個 狗 游水 呀
jin4zi1hau6 go3 gau2 jau4seoi2 aa3
'and then the dog swam'

(16) 青蛙 走 左²
qing1waa1 zau2 zo2
'the frog left'
*個 男仔 落 左² 去 跟住 羅² 翻 個 狗
go3 naam4zai2 lok6 zo2 heoi3 gan1zyu6 lo2 faan1 go3 gau2
'the boy went down and then took the dog'
跟住 個 男仔 跌 左² 落 去
gan1zyu6 go3 naam4zai2 dit3 zo2 lok6 heoi3
'and then the boy fell down (a cliff)'

(17) 跟住 隻 狗 係咁 追 隻 鹿 想 羅² 翻 個 男仔
gan1zyu6 zek3 gau2 hai6gam2 zeoi1 zek3 luk2 soeng2 lo2 faan1 go3 naam4zai2
'and then the dog kept on chasing the deer and wanted to take the boy back'
跟住 隻 鹿 跑
gan1zyu6 zek3 luk2 paau2
'and then the deer ran'

跟住　　個 男仔　　跌 左[2] 落 去
gan1zyu6 go3 naam4zai2 dit3 zo2 lok3 heoi3
'and then the boy fell down (a cliff)'

(18) *個 青蛙　　出 黎 呀
go3 cing1waa1 ceot1 lai4 aa3
'the frog is coming out'
*佢地　　搵 個 青蛙
keoi5dei6 wan2 go3 cing1waa1
'they are looking for the frog'
佢地　　去 搵 佢
keoi5dei6 heoi3 wan2 keoi5
'they are going to look for it'
佢地　　一味[2] 搵 同埋　　搵
keoi5dei6 jat1mei2 wan2 tung4maai4 wan2
'they keep on looking and looking for it'
佢 跌 左[2] 呀
keoi5 dit3 zo2 aa3
'it fell'

(19) *咁 個[2] 個 青蛙　　走 左[2]
gam2 go2 go3 cing1waa1 zau2 zo2
'so that frog left'
*咁 個[2] 個 狗狗　　出 到 去
gam2 go2 go3 gau2gau2 ceot1 dou3 heoi3
'so when that dog went out'
個 男仔　　講 青蛙　　係[2] 咧度
go3 naam4zai2 gong2 cing1waa2 hai2 li1dou3
'the boy said the frog is here'

(20) *男仔　　同 個 狗 訓 緊 覺
naam4zai2 tung4 go3 gau2 fan3 gan2 gaau3
'boy and the dog are sleeping'
青蛙　　走 囉
cing1waa1 zau2 lo3
'frog left'
*佢地　　搵 緊 個 青蛙
keoi5dei6 wan2 gan2 go3 cing1waa1
'they are looking for the frog'
*個 狗 跳 出 黎
go3 gau2 tiu3 ceot1 lai4
'the dog jumps out'

B.2 Chapter 5

Target classifier	Target object	Substitute classifiers/words	
		HS	HK
go3	apple	—	支 *zi1*, 粒 *lap1*, 舊 *gau5*
	bag	個[2] D[1] *go2 di1*, 隻 *zek3*	張 *zeong1*, 袋 *doi6*, 隻 *zek3*
	(foot)ball	隻 *zek3*	粒 *lap1*, 隻 *zek3*
baa2	scissors	個 *go3*, 雙 *seong1*	個 *go3*
	knife	個 *go3*, 個張 *go3zeong1*, 個支 *go3zi1*, 隻 *zek3*	個 *go3*, 支 *zi1*, 隻 *zek3*
	umbrella	丙 bing2, 個 *go3*, 個把 *go3baa2*, 個盼 *go3paan3*, 張 *zeong1*, 打 *daa2*	個 *go3*, 支 *zi3*, 隻 *zek3*
zek3	horse	個 *go3*, 呸 *pei1*, 條 tiu4	—
	hand	個 *go3*, 個隻 *go3 zek3*	個 *go3*
	butterfly	個 *go3*, 對 *deoi3*, 挑 tiu1	個 *go3*, 隻 *zek3*
tiu4	fish	個 *go3*, 隻 *zek3*	個 *go3*, 隻 *zek3*
	trousers	個 *go3*, 個條 *go3tiu4*, 張 *zeong1*	個 *go3*
	key	個 *go3*, 隻 *zek3*	個 *go3*, 抽 *cau1*, 支 *zi1*
lap1	button	個 *go3*, 隻 *zek3*	個 *go3*
	peanut	個 *go3*, 隻 *zek3*	個 *go3*, 舊 *gau5*, 隻 *zek3*
	strawberry	個 *go3*, 隻 *zek3*	個 *go3*
zeong1	bed	個 *go3*, 個張 *go3zeong1*, 個簡 *go3gaan5*, 條 *tiu4*	個 *go3*, 隻 *zek3*
	chair	個 *go3*, 個張 *go3zeong1*, 把 *baa2*	個 *go3*
	table	個 *go3*, 個張 *go3zeong1*	個 *go3*, 隻 *zek3*

Table B.3 Substitute classifiers used by each group

Appendix C

Summary of the performance of individual participants

ID	Group	Gender	AOT	Tone discrimination			Production			Classifier production	
				Overall	Similar contrast	Distinct contrast	Native-likeness	Compre-hensibility	Most votes for	Grammatical accuracy	Semantic accuracy
1	HS	Male	3;11	25	25	25				100	25
2	HS	Male	4;9	43.75	43.75	12.5				100	26.09
3	HS	Male	5;3	43.75	43.75	62.5					
4	HS	Female	5;7	37.5	37.5	37.5	3.67	2.93	Beijing	100	16.67
5	HS	Female	5;11	43.75	43.75	25	4.33	3.43	Beijing	100	25
6	HS	Female	6;2	75	75	50					
7	HS	Female	6;2	31.25	31.25	37.5	1.73	1.83	United States	31.25	28.57
8	HS	Male	6;3	75	75	100	2.47	2.57	Hong Kong	100	24
9	HS	Male	6;3	75	75	62.5					
10	HS	Male	6;4	0	0	0				100	30.77
11	HS	Male	6;4	0	0	0				100	24
12	HS	Female	6;4	81.25	81.25	62.5	2.3	2.13	United States	100	22.22
13	HS	Male	6;4	50	50	50	3.67	3	Beijing	64	36.36
14	HS	Male	6;7	62.5	62.5	50	3.27	2.33	Hong Kong	100	83.87
15	HS	Female	6;9	75	75	62.5	3.34	3.27	Hong Kong	100	18.75
16	HS	Female	6;10	62.5	62.5	37.5	2.13	2.1	United States	100	17.14
17	HS	Male	6;11	50	50	25	4.67	3.93	Beijing		
18	HS	Female	6;11	56.25	56.25	62.5	2.57	2.2	United States	95.24	23.81
19	HS	Female	6;11	25	25	25	3.77	3.57	Guangzhou	100	44.44

ID	Group	Gender	AOT	Tone discrimination			Production			Classifier production	
				Overall	Similar contrast	Distinct contrast	Native-likeness	Compre-hensibility	Most votes for	Grammatical accuracy	Semantic accuracy
20	HS	Female	7;1	43.75	43.75	25	2	1.97	Hong Kong	100	93.33
21	HS	Female	7;2	43.75	43.75	25	3.33	3	Hong Kong	100	58.33
22	HS	Female	7;2	62.5	62.5	62.5	4.03	3.47	Beijing	100	9.09
23	HS	Male	7;3	93.75	93.75	87.5	3.27	3.33	United States	100	35.71
24	HS	Male	7;3	0	0	0				100	36.11
25	HS	Male	7;4	75	75	75	2.23	1.8	United States	100	18.18
26	HS	Female	7;4	62.5	62.5	37.5					
27	HS	Male	7;4	75	75	50	2.67	2.47	United States	100	17.39
28	HS	Female	7;7	0	0	0				100	25
29	HS	Male	7;7	87.5	87.5	75	4.27	3.2	Beijing	92.86	19.23
30	HS	Female	7;9	50	50	37.5	3.53	3.53	Beijing		
31	HS	Female	7;9	0	0	0				100	29.63
32	HS	Male	7;9	0	0	0				100	20
33	HS	Male	7;9	75	75	75					
34	HS	Female	7;9	0	0	0				73.68	15
35	HS	Female	7;11	31.25	31.25	25	3	3.47	Beijing	100	19.35
36	HS	Male	8;1	68.75	68.75	37.5	3.33	2.77	Beijing	100	17.86
37	HS	Male	8;1	62.5	62.5	37.5				100	66.67
38	HS	Female	8;1	93.75	93.75	100	1.77	2.23	United States	100	69.44

ID	Group	Gender	AOT	Tone discrimination			Production			Classifier production	
				Overall	Similar contrast	Distinct contrast	Native-likeness	Compre-hensibility	Most votes for	Grammatical accuracy	Semantic accuracy
39	HS	Female	8;2	87.5	87.5	75				75	19.23
40	HS	Male	8;2	81.25	81.25	62.5	2.83	2.67	Hong Kong	100	71.43
41	HS	Female	8;5	0	0	0				100	11.11
42	HS	Male	8;7	0	0	0				100	20
43	HS	Female	8;7	56.25	56.25	50	3.57	2.57	Beijing	100	31.43
44	HS	Male	8;9	81.25	81.25	62.5	1.8	1.67	United States	100	21.43
45	HS	Male	8;9	81.25	81.25	62.5	2.53	2.33	Hong Kong	100	25.81
46	HS	Male	8;10	62.5	62.5	50	3.43	3.1	Hong Kong	100	26.09
47	HS	Female	8;11	0	0	0				100	12.5
48	HS	Female	9;0	75	75	50	2.8	2.77	United States	100	33.33
49	HS	Female	9;1	81.25	81.25	62.5	3.4	3.1	Guangzhou	70.59	15.38
50	HS	Female	9;1	62.5	62.5	50	3.5	2.83	Beijing	100	25
51	HS	Female	9;1	43.75	43.75	62.5				100	16.67
52	HS	Female	9;2	100	100	100	4	4.1	Hong Kong	100	35.29
53	HS	Male	9;5	81.25	81.25	62.5				100	22.73
54	HS	Male	9;7	81.25	81.25	75	3.37	2.47	Hong Kong	96.88	54.55
55	HS	Female	9;7	87.5	87.5	75					
56	HS	Female	9;8	68.75	68.75	37.5				100	27.59
57	HS	Male	9;8	0	0	0				100	15.15

ID	Group	Gender	AOT	Tone discrimination			Production			Classifier production	
				Overall	Similar contrast	Distinct contrast	Native-likeness	Compre-hensibility	Most votes for	Grammatical accuracy	Semantic accuracy
58	HS	Female	9;8	75	75	50					
59	HS	Male	9;8	87.5	87.5	75	2.3	2.03	United States	100	25
60	HS	Female	9;10	75	75	50				100	18.52
61	HS	Female	9;10	93.75	93.75	100	2.93	2.2	Hong Kong	100	21.05
62	HS	Female	9;11	75	75	50	2.13	1.73	United States	91.67	13.04
63	HS	Female	9;11	100	100	100				100	25.71
64	HS	Male	9;11	87.5	87.5	100	4	3.5	Beijing	100	20
65	HS	Female	10;0	81.25	81.25	87.5					
66	HS	Male	10;0	75	75	50	4.4	4.5	Beijing	96.67	50
67	HS	Female	10;1	81.25	81.25	62.5	3.77	3.73	Beijing	100	16
68	HS	Female	10;3	75	75	50	2.9	3.17	Hong Kong & Beijing	100	86.1
69	HS	Male	10;3	0	0	0				100	88.24
70	HS	Male	10;3	75	75	50	3	2.2	United States		
71	HS	Male	10;5	62.5	62.5	37.5	2.43	2.1	United States	100	17.14
72	HS	Female	10;6	81.25	81.25	62.5	3.1	2.4	Hong Kong	97.06	63.64
73	HS	Male	10;6	31.25	31.25	25				100	18.75
74	HS	Male	10;8	81.25	81.25	62.5	3.63	2.83	Hong Kong & Beijing	100	16.67

ID	Group	Gender	AOT	Tone discrimination			Production			Classifier production	
				Overall	Similar contrast	Distinct contrast	Native-likeness	Compre-hensibility	Most votes for	Grammatical accuracy	Semantic accuracy
75	HS	Male	10;8	0	0	0				100	45.45
76	HS	Male	10;8	68.75	68.75	50	3.07	3.07	Hong Kong & United States	100	26.67
77	HS	Male	10;8	43.75	43.75	12.5	3.63	3.21	Beijing	100	34.62
78	HS	Female	10;10	62.5	62.5	50	4.5	3.87	Beijing	100	43.75
79	HS	Female	10;11	75	75	50	2.53	1.8	Hong Kong	100	63.89
80	HS	Female	10;11	75	75	62.5	3.33	2.03	Beijing	100	47.06
81	HS	Female	11;0	62.5	62.5	50	3.73	3.1	Beijing	100	33.33
82	HS	Female	11;3	0	0	0				97.22	77.14
83	HS	Female	11;3	68.75	68.75	50	3.07	2.4	Hong Kong	100	16.67
84	HK	Male	5;3	81.25	81.25	87.5	1.37	1.53	United States	100	61.11
85	HK	Male	6;2	62.5	62.5	62.5				100	100
86	HK	Female	6;3	93.75	93.75	100				100	94.29
87	HK	Male	6;4	81.25	81.25	75				100	88.89
88	HK	Female	6;5	87.5	87.5	75				100	72.22
89	HK	Female	6;5	81.25	81.25	62.5	2.6	2.83	United States	100	88.57
90	HK	Female	6;7	87.5	87.5	87.5	1.13	1.33	United States	97.22	94.29
91	HK	Female	7;0	100	100	100				100	88.89
92	HK	Female	7;1	93.75	93.75	87.5	2.77	2.47	United States	100	91.67

ID	Group	Gender	AOT	Tone discrimination			Production			Classifier production	
				Overall	Similar contrast	Distinct contrast	Native-likeness	Compre-hensibility	Most votes for	Grammatical accuracy	Semantic accuracy
93	HK	Female	7;1	68.75	68.75	75	2.17	1.9	United States	100	66.67
94	HK	Female	7;2	100	100	100					
95	HK	Female	7;4	93.75	93.75	87.5				100	82.86
96	HK	Female	7;4	87.5	87.5	87.5				100	97.22
97	HK	Male	7;8	75	75	50				100	55.56
98	HK	Male	7;10	87.5	87.5	87.5				100	80.56
99	HK	Female	8;0	93.75	93.75	87.5				100	69.44
100	HK	Female	8;0	100	100	100				100	100
101	HK	Female	8;1	100	100	100				100	88.89
102	HK	Female	8;2	100	100	100				100	91.67
103	HK	Male	8;3	93.75	93.75	87.5				100	97.22
104	HK	Male	8;3	100	100	100				100	97.22
105	HK	Female	8;5	100	100	100	2.43	2.13	United States	100	100
106	HK	Female	8;5	87.5	87.5	87.5				100	100
107	HK	Female	8;5	93.75	93.75	87.5				100	86.11
108	HK	Female	8;5	100	100	100				100	94.44
109	HK	Male	8;10	100	100	100	2.83	2.57	United States	100	88.89
110	HK	Male	8;11	75	75	62.5				100	94.44
111	HK	Male	8;11	93.75	93.75	87.5				100	91.67

ID	Group	Gender	AOT	Tone discrimination			Production			Classifier production	
				Overall	Similar contrast	Distinct contrast	Native-likeness	Compre-hensibility	Most votes for	Grammatical accuracy	Semantic accuracy
112	HK	Female	9;0	75	75	62.5				100	91.18
113	HK	Female	9;1	93.75	93.75	87.5	2.73	2.2	United States	100	83.33
114	HK	Male	9;2	93.75	93.75	87.5				100	91.67
115	HK	Female	9;4	100	100	100				100	91.67
116	HK	Male	9;4	100	100	100				100	86.11
117	HK	Male	9;5	100	100	100	2.8	2.93	United States	97.22	57.14
118	HK	Female	9;7	93.75	93.75	87.5	2.23	2.33	United States	100	100
119	HK	Female	9;7	81.25	81.25	75				100	88.89
120	HK	Male	9;9	87.5	87.5	75				100	97.22
121	HK	Female	9;11	93.75	93.75	87.5				100	83.33
122	HK	Male	10;0	87.5	87.5	87.5				100	88.89
123	HK	Male	10;0	81.25	81.25	75				100	100
124	HK	Male	10;1	93.75	93.75	87.5				100	94.44
125	HK	Female	10;1	93.75	93.75	87.5				100	77.78
126	HK	Female	10;1	100	100	100				100	91.67
127	HK	Female	10;11	100	100	100				100	100
128	HK	Female	10;7	93.75	93.75	100				100	94.44
129	HK	Female	10;8	93.75	93.75	87.5				100	100
130	HK	Female	10;10	100	100	100				100	100

ID	Group	Gender	AOT	Tone discrimination			Production			Classifier production	
				Overall	Similar contrast	Distinct contrast	Native-likeness	Compre-hensibility	Most votes for	Grammatical accuracy	Semantic accuracy
131	HK	Female	10;10	93.75	93.75	87.5				100	94.44
132	HK	Male	10;10	87.5	87.5	87.5				100	97.22
133	HK	Male	11;0	100	100	100				100	94.44
134	HK	Female	11;2	100	100	100	2.5	2.53	United States	100	88.89
135	HK	Male	11;4	100	100	100	1.17	1.13	United States	100	86.11
136	HK	Female	11;6	100	100	100				100	94.44
137	HK	Female	11;6	87.5	87.5	75				100	94.44
138	HK	Female	11;6	100	100	100					
139	HK	Female	11;7	93.75	93.75	100				100	100
140	HK	Female	11;7	100	100	100				100	88.89
141	HK	Female	11;9	100	100	100				100	94.44
142	HK	Female	11;10	81.25	81.25	75				100	100
143	HK	Male	11;10	100	100	100				100	100
144	HK	Male	11;11	93.75	93.75	100				100	94.12
145	HK	Female	12;2	100	100	100				100	100
146	HK	Male	12;3	93.75	93.75	87.5					
147	HK	Male	12;4	93.75	93.75	100				100	91.67

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